THE SEARCH FOR EXTRA TERRESTRIAL LIFE IN THE UNIVERSE

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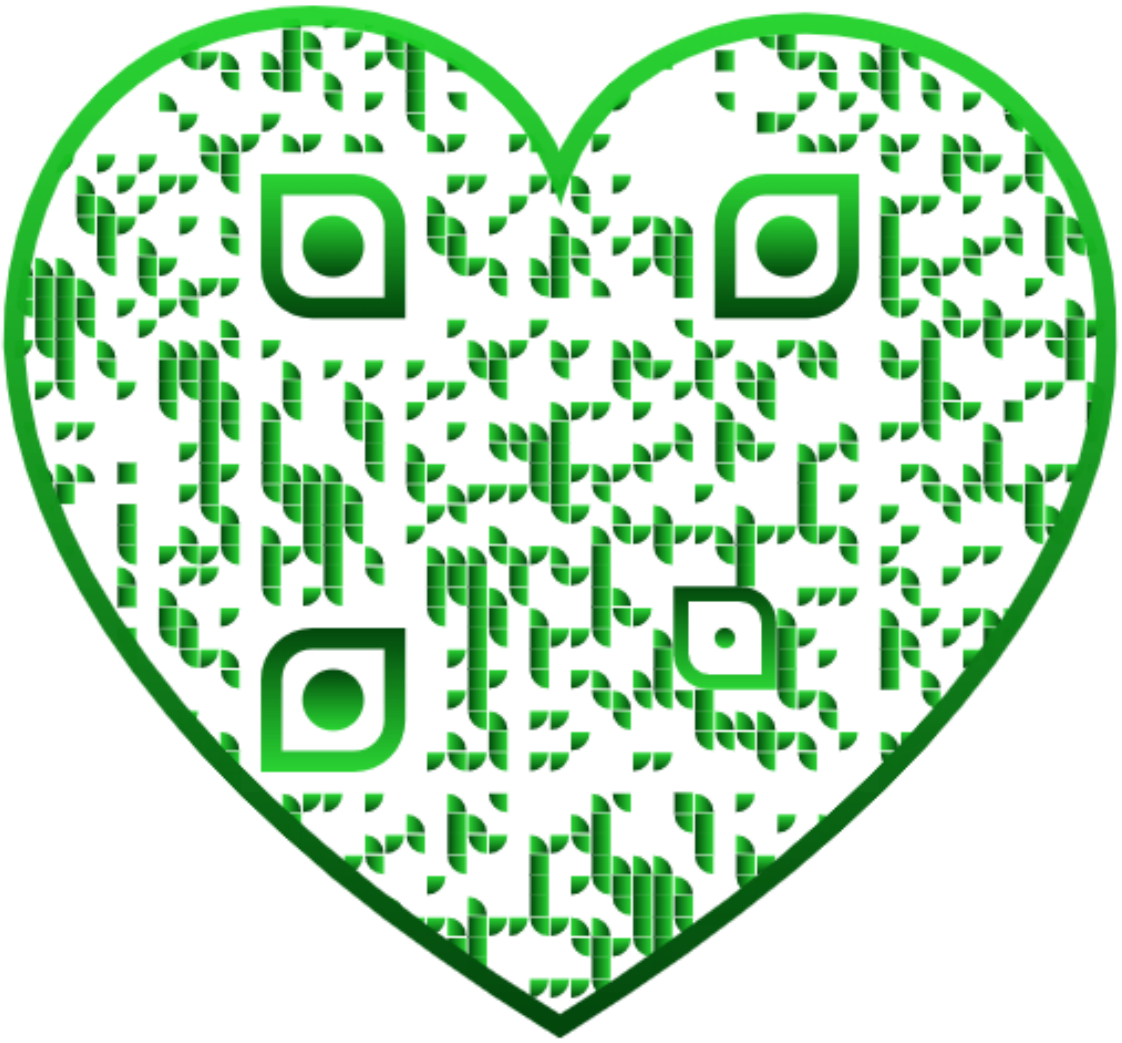

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Chapter-1 (The Grand Cosmos)

Why Extra-terrestrials

Since the ancients of times, when humankind first learned to look at the stars and mused over the majestic grandeur that this colossal universe celebrates, man always wondered, whether he is absolutely alone or there is life in distant planets out there, perhaps somewhere far and deep in the galaxies and possibly beyond. In those olden nights, when sky was clear and visible, unlike our present day fogged and tainted urban sky laden with many different kinds of pollutants, our ancestors would speculate and even aspire on the possibility of life on other planets, hoping to find a clue here and there, now and then, on the grand possibility that life exists, not just here on Earth, but elsewhere in the universe as well. And the search continued. For thousands of years, since the time we, the people, learned to reason and apply logic in our everyday existence, all of us at one point or another wondered about the possibility of extra-terrestrial life-forms, possibly even intelligent ones at it too. And with the application of science and steered by the blessings of modern day technologies, the search for life on other planets continues with a heightened energy that has opened up many incredible windows in the sky and made this ancient quest more thrilling. Any day now, there might just be that press conference by the NASA elites that would say, Ladies and Gentlemen, we are not alone in this Universe .

In the meantime, let s notice a remarkable aspect about our own planet. The strangest thing about this 4.54 billion year old dear Earth of ours is that, whatever we need to survive and flourish as a species and as a civilization, all that can be found here on this magnificent blue planet. And this truly makes this 3rd planet from the Sun unique and so far, spectacularly, one of a kind. And given the astonishing significances of our planet, it was the ancients belief that our planet Earth was the

centre of the universe. But this idea, somewhat quite selfish, couldn t stand the test of time.

How this revolutionary idea that Earth is not at the centre of the universe came to be is one of a fascinating one. It all began on January 7th, 1610, when the esteemed Italian astronomer Galileo Galilee aimed his telescope towards the planet Jupiter and noticed three small stars near the planet, one of which was off to the west and the other two were to the east, all lying in a straight line. The observation from the subsequent nights revealed that all three stars were now positioned on the west of Jupiter however still in a straight line. On January 10th, he noticed that one of them had disappeared and Galileo suspected that the missing star was perhaps located behind Jupiter. These stars were in fact three of the Jupiter's four largest satellites, i.e. moons, Io, Europa and Callisto and on 13th January Galileo discovered the fourth one, Ganymede. Today we know these four satellites of Jupiter as the Galilean moons. Vigilant observations of these supposed stars lead Galileo to this revolutionary conclusion that these were in fact small satellites orbiting around the planet Jupiter. And this finding was very contradictory to the traditionally held geocentric view of the Aristotelian cosmology which stated that Earth was at the centre of the universe and all heavenly bodies circle the Earth. But the course of the four moons of the Jupiter firmly convinced Galileo that Earth, in fact, was not at the centre of the universe and he resolutely echoed the Copernican heliocentric view (developed by the polish scientist Nicolaus Copernicus around 1543) that Earth is just a planet orbiting around the Sun, which is at the centre of the solar system. Galileo's stance on Copernican view further strengthened when he observed the full set of orbital phase of Venus which he found to be similar to that of the moon. Before that it was traditionally believed based on Ptolemy's geocentric model that the orbit of the Venus was specifically placed entirely on the near side of the Sun. But Galileo's telescopic observation of Venus's orbit around the Sun made this Ptolemaic astronomical model invalid and it is believed that this crucial finding

made a significant contribution for the transition of mankind's astronomical approach from geocentric to heliocentric point of view.

Now in regard to how Copernicus came up with his heliocentric idea at the first place which influenced Galileo in his own research needs to be addressed briefly. Research has found that mathematical techniques developed in the 13th-14th centuries by the noted Muslim astronomers like Mo'ayyeduddin Urdi, Nasir al-Din al-Tusi and Ibn al-Shatir for planetary motions closely resemble to some of those used later by Copernicus in his heliocentric models. And many say Copernicus s heliocentric model was a rendition of existing ideas developed by the olden astronomers, including Muslim ones, from the previous centuries. For example, noted Persian scientist Fakhr al-Din al-Razi (1149 1209) opposed the Aristotelian idea of the Earth centric universe and instead argued that there are thousands of worlds beyond this world to that extent that each one of those worlds are bigger and more massive than this world as well as having the similarities to that of this world. This also clearly indicates early scientists interest in the extra-terrestrial life and intelligent civilizations across the universe.

It is now scientifically acknowledged that Earth isn't even at the centre of the solar system. In fact the solar system that we are in is not even at the centre of our galaxy and our galaxy is no way in any special position in contrast to the rest of the known universe. So, from an astronomical viewpoint, Earth is not enjoying any privileged position in space even though she is a remarkable planet herself. And given the vast arrays of stars, galaxies and planets that decorate our cosmos, chances are there ought to be beings like us, residing in some distant planet, out there far, far away marveling on the uniqueness of their own planet themselves. The fact is, at the end of the day this 15 or so billion year old Universe of ours is pretty big. From what is scientifically understood, there are more planets out there than all the sand grains combined in all the beaches of Earth! And that is indeed quite a number. So, from an astronomical viewpoint, sadly, Earth is not enjoying any privileged position in space. If life only thrived here on

Earth and no where else, then clearly such colossal nature of the universe seems like an awfully waste of space.

From what is understood about our known universe is that, it may be infinitely large and the one that we are familiar with might as well be one of many universes that are possibly our there in the vast regions of space and time. So life would pop up only on planet Earth and no where else in this massive cosmic existence, does not sound entirely logical. Let s consider Hubble Space Telescope s (HST) findings in this regard that perhaps could provide some light into this mystery. According to this American space telescope s finding which was launched on April 24, 1990, there are at least 125 billion galaxies in the universe and counting, at least 10% of all sun-like stars have a system of planets and there are billions of stars with planets orbiting them in the universe. And even a billionth of these stars have planets that support life then there are around 6.25 billion life-supporting solar systems in the universe. And with that many life supporting solar systems, chances are there are planets like Earth out there that supports life and all that it requires for that life to flourish and evolve. According to Prof. Stephen Hawking, one of the most brilliant minds of our time, given that there are more than 100 billion galaxies out there each containing hundreds of millions of stars, so the thought that the systematic evolution of life only took place here on Earth and no where else, is somewhat impractical. In 2010, in a TV series for the Discovery channel, this is what the world renowned theoretical physicist had to say about the issue. In his own words, To my mathematical brain, the numbers alone make thinking about aliens perfectly rational. The real challenge is to work out what aliens might actually be like . It is Prof. Hawking s speculation that, as far as our own solar system is concerned, that most extra-terrestrial life would be similar to microbes or small animals that could exist beneath Martian surface, where liquid water is thought to trickle through the rock. And massive marine creatures could also conceivably exist as well in the oceans underneath the mile-thick icy layer of Europa, one of Jupiter's 4

moons. But what lies beyond our solar-system that is a whole different story. According to many experts along with Hawking, if there is a scientific census of the rest of the Milky Way and beyond, the odds in favor of extra-terrestrial life's existence would rise dramatically.

With all the speculations and the possibilities, what the extra-terrestrial life-form might actually look like? Are they going to look like the way Hollywood routinely projects alien life-forms with violent imaginaries and devastating implications upon contact or would they be something different, something that even our most ingenious minds haven t been able to sketch yet. Only time will tell however astro-biologically (the study of the origin evolution, distribution, and future of life in the universe) speaking, there are many arguments on what extraterrestrial life would be like. There are some who believe that all life is like life on Earth that is carbon-based life forms while there are others who believe silicon and even ammonia-based life forms could exist on other planets. There are two accepted hypothesis regarding the origin of extraterrestrial life one of which proposes that it may have emerged independently from different places in the universe while the alternative one, the Panspermia hypothesis, a concept that goes back as far as 5th century BC, says that life emerges from one specific location and then spreads between habitable planets. But in order to understand the emergence of life, here on Earth and possibly elsewhere, we need to understand the beginning of the universe itself at first.

In the Beginning

It all began approximately 15 billion years ago when this gigantic house of infinite number of celestial matters commenced its journey and just astonishingly at that very moment of its birth, this universe was merely compacted together in a single tiny volume which was incredibly hot and unbelievably small, in fact much smaller than an atom! It is scientifically believed that this miniscule point of origin of our universe burst into existence with a Big Bang which is simply an explosion of such immense power and magnitude that the material of

the universe is hurtling away from it in all direction till today. And with this Big Bang, began the clock of time and every thing else. What happened before that is a matter of great mystery and subject to great research. The closest contender to the Big Bang theory was the Steady State theory developed by the English astronomer Sir Fred Hoyle in the 1940 s. This theory basically stated that universe has no beginning or end in time rather always is expanding and matter is continuously created at a rate that keeps the average density of the universe the same as it expands. But this steady state theory did not survive the test of time as now; the Big Bang Theory is the accepted explanation in understanding the evolution of our universe. But it is interesting to note that it was Hoyle who actually coined the term Big Bang in an attempt to put down the idea that the universe had a beginning. And speaking of Big Bang theory, this particular idea was first proposed by a Belgian priest, Father Georges Henri Joseph Édouard Lemaître who was also a scientist and suggested the idea in a paper titled Hypothesis of the primeval atom in 1927.

Today there are very few disputes regarding the Big Bang theory. And apart from numerous powerful scientific piece of evidences in its favor, the most convincing argument is that since the universe is continually expanding, then in the past, it must've smaller. Besides, the most compelling evidence of Big Bang Theory came in 1992, from the findings of COBE (Cosmic Background Explorer) satellite which detected the cosmic ripples of that enormous blast that took place 15 billion years ago. This cosmic ripples is known as the Cosmic Microwave Background Radiation (CMBR) which is basically the residual heat from the moment of creation, the afterglow of the Big Bang that is distributed throughout the universe uniformly and with equal intensity in all directions. But the most remarkable part is the events that followed right after the big bang which eventually ushered life as we know it here in the Universe.

Here is what followed right after the Big Bang. That incredibly hot and unbelievably small point which evolved into this universe began to

expand at an astonishing rate, mushrooming to the size of our very own solar system within the first Picosecond (A Picosecond is 10^{-12} of a second, that is one trillionth, or one millionth of one millionth of a second, or 0.000 000 000 001 seconds. In other words a Picosecond is to one second as one second is to 31,700 years. This time period is so short that it has its own name called Planck time). And then cooled down rapidly from a temperature of 10^{32} K (10,000 billion billion billion K and K here is the Kelvin which is a unit of measurement for temperature) to 10^{16} K (10 million billion K) as the universe started to expand.

Since the start of the Big Bang, when the temperature of the universe was 1032 K, the four forces of the universe (gravity, electromagnetic, strong and weak nuclear force) started unify and when the temperature was 1028 K, matter began to form in the shape of a swirling soup of quarks and leptons (electrons and neutrinos) followed by the split off of gravity from the other three forces. And during the "period of inflation" which is the first 10-35 and 10-32 seconds, the universe continued to grow fast and by 10-6 seconds the temperature dropped to 1013 K when quarks began to combine while the weak nuclear and electromagnetic forces started to split. After the very first second of the Big Bang, the temperature dropped to 1010 K, and the quarks began to combine electrons and neutrinos together in triplets to make hadrons (protons and neutrons). Within three minutes, the universe was many light years across and the temperature gradually dropped to below 1 billion K which is about 70 times hotter than the interior of the Sun today. And right at that point of time, neutrons and protons began to stick together to form atomic nuclei like deuterium and helium.

As time went on, the rate of the cooling dropped rapidly and the velocity of the expansion slowed down yet the process continued as the gravity began to take effect. After 10,000 years, the temperature dropped to 105 K and all the celestial matters and radiations were thoroughly mixed up in a dense of "fog" which was eventually cleared up after 300,000 years since the occurrence of Big Bang when the

electrons began to bind to hydrogen and helium nuclei to form the very first stable atoms. And pretty soon the universe was filled with swirling, primordial gas clouds that gradually curdled into long thin strands and it is these strands that clustered into galaxies and at 4 billion years first stars appeared in the universe within these galaxies.

The other Fantastic Four

At first it may seem somewhat uncanny, but all the infinite range of events that is going on in the universe is supremely commanded by the operations of one or more of the four forces of the universe. These are gravity, the electromagnetic force, the strong and the weak nuclear force. Amongst these four, gravity, which is the most familiar one yet scientifically least understood, is the force that keeps our feet to the ground and not only holds the Earth and other planets in orbit around the Sun but also prevents the stars into disintegrating and unites stars into galaxies.

What is this mysterious gravity at the first place? The honest answer is, no one knows. Yet no object in this vast Universe is immune to the power of gravity. The magical the universe is, everything in it is full of movements and orbits. Satellites orbit planets, planets orbit stars, stars move around the centers of galaxy and galaxies revolve in clusters, and all of these only because of gravity. Starting from the journey of dead leaf fluttering down towards earth to celestial objects of gigantic proportions moving through the space, it is gravity that contains all of their motions. To put it simply, without gravitational force in action, moving objects in space would plunge off in straight lines and in all direction, which is purely a recipe for colossal cosmic disaster. To put it simply, gravity is a naturally occurring phenomenon, invisible by nature, which compels physical matter in this celestial sphere to attract each other with a force exactly proportional to their mass. And the more matter is inside of an object, the commanding the power of its gravity is. Say for example, our sun contains so much matter that its massive gravity makes all the planets in this solar system orbit around

it in very systematic and predictable manner. Being one of the four fundamental forces of the Universe, it is understood that it is gravity that is responsible for isolated matters to come together, combined matter to remain intact, a process which cosmically ensures the existence of planets, stars, galaxies and much more. It is also really mysterious that, the force that is responsible for keeping us glued to Earth is also one of the least understood aspects of science. Although Sir Isaac Newton tried to make a sense of it about 300 years ago with his Universal law of Gravitation, however, gravity remains somewhat a mystery despite it being the dominant force in the Universe, effective over huge amount of distances in the vast arrays of the grand cosmos.

Since Newton s contribution in understanding gravity was pivotal, few words are in order to tribute this eccentric genius. Undoubtedly one of the most brilliant minds ever in the history of mankind, Sir Isaac Newton was a scientist par excellence and a scholastic extraordinaire. The marvels of this English physicist, mathematician, astronomer and theologian are indisputably acknowledged as crucial to the betterment of human understanding of the ways of the world and certainly, that of the Universe. More than two centuries after his death, Newton, whose genius is celebrated truly for laying much of the groundwork for modern physics, astronomy, mathematics and the study of optics, remains the foremost scientific intellect whose excellence in natural science continue to mesmerize all within the periphery of the Earth. But surprisingly, even though today we know Sir Isaac Newton as a scientist however he was, in fact, an alchemist by heart and practiced this mystic art with great deal of devotion and splendor. The truth is, astonishingly, Newton spent most of his lifetime studying numerous branches of occult studies and alchemy than all the work he did on aspects of natural sciences that he is known for today. It is believed now that Newton's very own scientific works were somewhat of lesser personal importance to him as he himself prioritized more on rediscovering the occult wisdom and the mystic ways of the ancients.

It was learnt back in 1936 that a collection of Sir Isaac Newton's unpublished papers were being auctioned in Portsmouth and in them included three hundred and twenty-nine lots of Newton's manuscripts, over a third of which are filled with his writings that were exclusively alchemical in nature. At this point it must be understood that contrary to the popular belief that alchemy (going strong for over 2,500 years) is all about turning matters into gold, this ancient practice is in fact the quest of achieving the ultimate spiritual wisdom and the persuasion of heavenly illumination of the human soul. The stanch secrecy of the practice which involves the ancient of ways is what makes the philosophical systems of alchemy a deeply mysterious one.

The true nature of this particular alchemical writings of Newton is believed yet to be revealed as many feared deeply that if the secret contents were to be exposed it might usher dire consequences to the affairs of the world, a thought shared by Newton himself in his lifetime regarding his all consuming devotion to the esoteric mysticism of various natures. But it was not only the alchemy that Newton was all consumed in for his deep passion with regard to mysticism and spirituality. Sir Isaac Newton, a deeply religious man, studied the Bible extensively and with faithful efforts and made numerous attempts to extract and decipher hidden messages and scientific information from Bible. And in 1704, in a manuscript he estimated that the world will come to an end around 2060. But many scholars believe that Newton, with his Aryanism and Anti-Trinitarianism stance, was, in this regard, actually referring to a time when the restiveness of the World was to be replaced by an era of divinely inspired peace and stability. In 1728, Isaac Newton penned down an extensive manuscript titled The Chronology of Ancient Kingdoms concentrating on various ancient Eurocentric kingdoms focusing on Greece, Anatolia, Levant and also Egypt, which many belief was an effort initiated by Newton to understand the ancient occult practices and mysticism studies. In this particular manuscript Newton, dedicated an entire chapter on the Temple of Solomon reflecting his original interest in the temple's

sacred geometry but as he studied more on the architectural components of the ancient temple his original interest graduated to a genuine belief that the geometry and the mathematical structures of the temple were in harmony with the size of world and man's place and proportion to this beautiful blue planet. Newton believed that the works of ancient philosophers and scholars were embedded with mystical and sacred wisdom hidden in the language of symbols and mathematics which, if and when deciphered, would reveal a mysterious yet uniquely powerful knowledge regarding the magical elements and the supremacy of nature. Rumor has it he was successful in this particular quest of his. In the same manuscript of the Ancient Kingdoms, Newton wrote several passages on the mythical land of Atlantis expressing his belief that Homer's Ulysses left the island of Ogygia in 896 BC (Ogygia was the home of Calypso, the daughter of Greek God Atlas, after whom the legendary land was named) along with the thought that Ogygia and Atlantis were geographically connected.

Throughout his entire life, Sir Isaac Newton was believed to have been involved with numerous powerful secret societies and Gnostic fraternities that are devoted to the ancient practice of occults and esoteric understandings. One such society was Rosicrucian, a philosophical ultra-secret society founded in the late medieval Germany which's doctrine revolved around knowledge built on esoteric truths of the ancient which provides great insight into the nature, the physical Universe and the wondrous realm of spirituality. Aside from analogous alchemical spiritual systems, it is believed one of the aspects that attracted Newton to this society is their exclusive ability to communicate with Angels and the spirit world (presumably) which many scholars believe coincided with Newton's visionary belief systems. It is also believed that Sir Isaac Newton was a freemason of highest degree as well as a member of the fraternal organization Priory of Sion, the secret society founded in 1099 AD, allegedly to protect the bloodline of Jesus Christ.

Despite his unpleasantness and lifelong dedication to the esoteric mysticism, Sir Isaac Newton was a gifted individual who understood the grandeur as well as the obscurity of the Universe with great deal of precision as well as admiration. We live in a world where much of its affairs are vaguely understood, let alone the enigmatic ways of the whole Universe. Mankind surely has a long way to go and Newton realized it very well. This is what he wrote before his death, I do not know what I may appear to the world; but to myself I seem to have been only like a boy, playing on seashore, and diverting myself, in now and then finding a smoother pebble or a prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me .

Now, getting back to gravity, despite holding the Universe together, gravity, experts believe, is almost negligible on an atomic scale, even though every single particle, regardless of its size, exerts a gravitational force. One interesting fact concerning gravity is that, it s all about mutual attraction. When a stone falls into the ground, it is due to the fact that Earth s gravity is pulling it down. But the stone s gravity also attracts the Earth upwards as well, however the stone s mass is so small that it s pull towards Earth is very insignificant. And it is this mutual attraction that keeps satellites orbit around planets, planets orbit around stars, stars move around the centers of galaxy and galaxies revolve around in clusters. It is also recognized that the force of gravity distorts objects slightly, which is traditionally understood as the tidal-effects, which are in fact very common in the Universe, the most familiar one being our Earthly oceanic tidal effects. Even though it is clear that, it is gravity that pulls matter together across the space, however, how this force is actually transmitted is still not clear. But many believe that Einstein s General Theory of Relativity provides some clue regarding this quest. This theory of Einstein showed that gravity works by bending space and time. And in recent times, physicists commenced the speculation that gravity might just travel in waves of photons called gravitons. These gravitons, scientists believe, like photons of light, act as messengers, carrying the gravity signal

between objects in gravity waves. It is also supposed that, these gravitons travel back and forth between Earth and the Sun, keeping the orbital process of each other constant and rhythmic.

After gravity, lets understand Electromagnetism or the electromagnetic force which provides the lights for stars like Sun and sustains the attraction between atoms that hold bodies and plants together along with triggering the vital chemical reactions that enable not only plants to grow but also human's to progress physiologically. To understand the electromagnetic forces criticality, it can be stated that it is what gives us the light. But what is this light? With table lamp having as an example we can perhaps get more insight towards this crucial universal force. At first when the lamp is switched on, an electric current made up of a stream of electrons flows through the filament. And within this filament the electrons bombard the atoms and give them energy which heats up the filament and eventually makes the atoms so energetic that they give off that energy that they have received as visible light.

Behind the most dramatic of events in the universe whether it is the nuclear blasts in Hiroshima and Nagasaki in WWII or the burning of enormous star like that of our Sun in some other distant galaxy, it is the strong nuclear force that is in works of such plunder and wonder. Being one of the four forces of the universe, it is this strong nuclear force that heats up the sun. But where exactly lays its criticality? All nuclear reactions are the result of this strong force and it is this force that binds the nucleus of each atom together. And since atoms have positive electoral charges, without this strong nuclear force to hold them together all the protons in the nucleus would repel each other violently and end up hurling apart and the neutrons would be held only loosely in place loosing the ability to create any nuclear reaction, thus energy. During nuclear reactions when atomic nuclei merge together (nuclear fusion) and split (nuclear fission) the strong nuclear force is released in a huge binding energy and on Earth it is this energy that is used to release a devastating amount of energy through fusion or hydrogen bombs. And in space it is what powers the stars, like that of

our good old sun. The weak nuclear force on the other hand is the force that blasts the outer layers of an exploding supernova into space which as a result creates a cloudy ring of expanding gas. The subtle presence of weak nuclear force helps break up atoms slowly and on Earth this particular process changes the chemical nature of the carbon in trees. But it is the weak nuclear force that steadily breaks up the carbon-14 atoms in dead organic matter which allows us the earthlings to identify the time of its death by measuring the proportions of these atoms still intact, a technique which is widely known as radiocarbon dating.

The dating procedure of fossils use the same method, only instead of carbon-14, the remains of potassium-40 is studied to pinpoint the time. Besides operating over the smallest range of all the four forces (about the size of a proton or a neutron) the weak nuclear force is considered as the universal force for change unlike the rest of the three forces, which either push or pull. Research is underway to link the four forces of universe for greater earthly purposes. Already the idea of electromagnetic super force is underway by combining the electromagnetic, strong and the weak nuclear force. But how gravity is incorporated with the rest of the three is a matter of great interest and intense research, something which researchers believe will altogether lead to the creation of one single super force. And how life emerged in the midst of all these after years of spectacular cosmic and planetary evolution is a matter of great mystery.

Let there be Light

The emergence of life in the universe, especially human life, is perhaps an aspect far more enigmatic than complex as it is much more than a random event since it required the presence of right things at the right places and at exactly the right time. It is understood that the presence of four chemical elements such as carbon, oxygen, nitrogen and phosphorous are crucial for the origin of life as we know it. But only hydrogen and helium was formed immediately after the Big Bang. Before more complex elements could form that are essential for the

sustenance of life, stars had to come into existence to forge them in their fiery interiors, and then run their natural life to release them into space. And in order to allow these elements to evolve, the balance between the four forces of the universe just had to be right. And it took billions of years for the universe to allocate these elements to come together to form the first complex amino acids and then self-producing chemicals in an environment where life could progress and sustain. Here on Earth, it is believed that the chemicals of life was first possibly formed when lighting flashes in Earth's primeval air turned water, carbon dioxide, methane, ammonia and carbon monoxide into amino acids such as Adenine, Guanine, Cytosine, and Thymine which are the basic chemicals that forms proteins, life's building block.

And life started to sustain once organic molecules learned to make copies of themselves so they could pass on the instructions to ensure their survival. And this crucial self-replication is based on DNA or deoxyribonucleic acid, the hereditary material in humans and almost all other organisms. It is in the DNA where Adenine, Guanine, Cytosine, and Thymine are stored as a chemical bases and the human DNA consists of about 3 billion bases, and more than 99 percent of those bases are the same in all people. The order, or sequence, of these bases determines the information available for building and maintaining an organism, similar to the way in which letters of the alphabet appear in a certain order to form words and sentences. And all of these have evolved from the warm oceans of primeval Earth, the only planet in this solar system that orbits the Sun in the habitable zone where water is at the exact right temperature to be liquid, a key to the flourishing of life here on Earth.

Now, since we are talking about life on Earth and elsewhere we must consider the Anthropic principle in this regard which basically states that we live in a universe that has systematically set itself up to ensure our existence as intelligent beings. That means, if the laws of the universe were any different from what they are today, we wouldn't be here to study them. Consider a few fascinating facts concerning our

own planet. The protons, the positively charged sub-atomic particles, happen to be 1,836 times heavier than electrons. If they were a little bit bigger or smaller, we wouldn't be here today. If the Earth's Albedo (the total amount of light reflected off the planet versus the total amount of light absorbed) was much greater than what it is, then the Earth would have experienced a runaway freezing, a process which freezes all liquids. And if it was any less, then the same runaway greenhouse effect would be inevitable. If our Earth's magnetic field was weaker, it would've been devastated by cosmic radiation and if it were stronger, we would've been eliminated by electromagnetic storms. Same is true of the planet's place in the solar system and the solar system's place in the galaxy as well as the very color of our Sun, all of which just had to be right for life to thrive on this green planet.

There are basically two Anthropic principles and they are strong Anthropic principle and weak Anthropic principle. The Strong Anthropic principle states that, the universe had to bring intelligent life into existence at some particular point and specifically housed those particular properties that allowed life to develop at some point of its 15 billion or so years of history. And the Weak Anthropic principle states that only a universe with an appropriate structure is likely to sustain intelligent life-forms. According to Weak Anthropic principle, our existence on Earth, as carbon-based intelligent life-forms, imposes a sort of selection effect on the universe, where our knowledge of our existence imposes rules that select, out of all possible environments, only those particular environmental settings with exclusive characteristics that allow the sustenance of life. Basically, the first idea states that, we're here because our universe is here and the second one tells that our universe is here because we're here. And it is the Strong Anthropic principle that suggests that once intelligent life has appeared, it'll never die out.

To Be or not to Be

Now the question is whether Earth is the only planet where life hasn t died out, in fact evolved over time or are there planets like ours out

there in this great vicinity of this grand cosmos of ours where life evolved into intelligent ones as well. After all these complicated cosmic evolutionary process for billions and billions of years, life would only exist on Earth and no where else sounds quite unreasonable. Now the question is, if intelligent life is surely out there, then how come in the 4.5 billion history of Earth, this planet of ours has never been contacted or visited by entities from some extra-terrestrial civilization.

Who is to say that contact hasn t been made?

Given the number of UFO sightings every year and the many theories of Ancient astronauts, which will be discussed elaborately later, many say contacts have already been made. But then again so far there haven t been any compelling evidences out there in the recorded history of mankind that would unite people of the world, from every possible corner of this civilization to unanimously acknowledge that fact indeed there is an extra-terrestrial civilization out there where communications between the Earthlings and them have been established. Again this also does not mean that out of billions of billions of planets roaming in this Milky Way galaxy and countless of others, there aren t any out there that does not host life and sustain the environment to flourish and evolve it into able one. So, if there are these billions of planets with possible civilizations out there, where are they?

And this leads to the famous Fermi paradox, developed by the physicist Enrico Fermi which basically states that, with 15 billion years of history, with more than 80 billion other galaxies in the observable universe and high mathematical estimation of planets with possibilities of extra-terrestrial life-forms, then by this time, a civilization with a modest amount of rocket technology and certain amount of imperial incentive should have rapidly colonized the entire Milky Way Galaxy within the last ten million years which is considerably quite a short time compared with the age of the Galaxy, which is roughly ten

thousand million years. But none of that happened. So in that regard lays the Fermi s famous question, Where is everybody?

The easiest and most logical answer is, out there. Just because we haven t been colonized, that doesn t mean that there are not any intelligent civilizations out there. Just because we, the Earthlings, so far haven t discovered any, that doesn t mean that there are none out there. Much before the beginning of the European colonial quests, regions that ultimately succumbed to their imperial authority enjoyed a sovereign and prosperous way of life which had little to do with European way of doing things. Both sides of civilizations existed in their own right before the beginnings of the colonial expeditions without almost the knowledge of each others existence. There might be civilizations out there we are not aware just as that particular civilization perhaps not aware of our existence. Also how logical it is to perceive that an extra-terrestrial civilization will be all out colonial. A civilization that old would certainly know better, as with age comes wisdom. Also with our own experiences within our very own planet s history, we have seen that it is not possible for much superior civilization, especially an invading one, with all the technological advancement to continue for ever its colonial authority towards an inferior one. So, arguing in line of Fermi s point, even if a massive colonization have taken place in the past, chances are some sort of cosmic rebellion have, in time, quashed that imperial agenda. However, no such relics of cosmic rebellion have ever been discovered, which also tells us that perhaps, no civilization in the cosmos experienced such phenomenal growth yet or collapsed on itself before beginning it s intergalactic colonial ambition. Just as Earth is a growing planet ruled human being with their own limitations, there ought to be other planets out there housed by equally complicated biological organisms with their own set of limitations and shortcomings. It will be a gross mistake to perceive them to be flawless, all powerful mighty invincible, all knowing creatures. If they didn t have any weaknesses or some level of technical inadequacies

due to their still evolving intellectual capabilities, they wouldn t be any life-forms at the first place.

Also there is another issue that why mankind, with their state of the art technology, are yet to contact or locate Earth like planets out there or civilizations that are intelligent to a considerable extent. Some answers should ve come by now. We must understand that when we are talking about intergalactic communications between two or more planetary beings we must consider the spectacular size of the universe and the time it takes to establish communications between two or more parties in the midst of all these cosmic features. Let s focus on an example. It is known that light travels at the speed of 1, 86, 000 miles per second and every cosmic matter that we see from Earth are already in their past form. Say for instance, the distance from Earth to Sun is 8 minutes in light years term. That means the Sun we see, the heat we experience from its own geological activities, all takes about 8 minutes to reach Earth. The Sun could be destroyed into pieces and we would not know about it for 8 minutes. Now what is the point of all these light year travel and past cosmic events? The point is, even if there are a million advanced civilizations in our galaxy, The Milky way, alone, the average cosmic distance between the civilizations would be about 300 light years. This means that if, one civilization contacts another, the one way transit time for such communication will be 300 light years. And it will take another 300 years to respond and in total 600 years within in light years terms, within which time a lot can take place including the extinction of the life forces of the planet themselves. After all, our own planet experienced two world wars in the span of just 40 years that almost wrecked the entire world. Let s take another example on this. One of the fastest space vehicle that mankind ever made was Pioneer 10 which has the coverage power of 25 miles per second. Even if Pioneer 10 travels at that speed, it would take the spacecraft about 33,000 years to reach Proxima Centuri which is the closet star system that we have to our own solar system. And a trip across our Milky Way to the Andromeda Galaxy in Pioneer 10, the

nearest galaxy similar the galaxy that we live in, would take about 15 billion years which is as long as the Universe and time existed.

According to scientific observations, the observable part of our universe which is about a astounding 93 billion light years in diameter! That is indeed quite a distance. Let s take another example that reflects that colossal nature of the universe as 300 light years is a miniscule amount of time compare to the space and time factor in respect of astronomy. From the Sun to the centre of the Milky Way galaxy is 30,000 light years. From our own galaxy to the nearest spiral galaxy (there are 3 types of galaxies: Elliptical, Spiral, and Irregular) named M31, the distance is 2, 000, 000 light years. The light we see today emitting from the M31 that started its journey that many long years ago, there were no human beings on planet Earth which was roamed, back then, by our ancestors who were still evolving to become what we today refer as Homo sapiens. Many of the cosmic features that have been discovered and being discovered are the news of many billion lights years ago, back when the Milky Way, let alone Earth was not even formed. So, the point is, when it comes to communicating with beings from other civilizations, these distances in space and time are crucial and possibly the second greatest obstacle in establishing any kind of celestial contact right after the concern of the availability of recourses and technology to do so.

Since time is such a crucial factor in space traveling, then what about space exploration via time travel mechanisms? Clearly if we could save time and figure out the point of destination we certainly can ease up the cosmic exploration process and quite comfortably and possibly reach out to a planet that hosts life and possible intelligent kind at that it too. There has always been a great deal of interest about time-travel. It has been the centre of many science fictions. Frankly, who wouldn't want to travel through time and aspire to a part of this surreal experience? Secretly as well as openly there ve been many researches in this regard. And amongst all, one possibility that truly makes sense, is the usage of Wormholes as possible cosmic time travel portal.

Noted physicist Albert Einstein's Special Theory of Relativity showed how time itself could slow down, given one is traveling close to the speed of light. But the actual possibility of time-travel was sparked by the idea of utilizing black holes as it is known that they bend space-time. Now what is Black Hole? When a star dies out, especially those over 30 times the mass of our Sun, the cores of these massive stars collapse dramatically as the fusion reactions that used to power them ceases down. Due to the gigantic nature of such star, gravity eventually pulls matter inward relentlessly and as a result the core of the star quickly passes through the white dwarf and neutron star stages (the other fates of a dead star). What is followed afterwards is phenomenally wondrous as the star keeps on collapsing until it disappears into a point that is infinitely smaller than the full stop we use to mark the end of a complete sentence. It simply becomes a massively heavy, infinitely dense and dimensionless object called a singularity . It has been found after intense scientific study that the gravitational field around a singularity is so strong that absolutely nothing, not even light can escape from its pull. Naturally, even when lights from distant stars and planets gets sucked in, absolutely anything that falls into the singularity is completely lost forever. And because of this particular feature, the space around a singularity where light cannot escape is known as black hole.

But in respect to time travel, how to overcome the paradox that anything that falls into the black hole is drawn toward the singularity at its centre and crushed into nothingness. However, there are suggestions that, the traveler might avoid the singularity of black hole and pass through a small passage into a different realm of space-time, say another locale in universe where alien life existed, exists and will exist. And this passage is termed the Wormhole! But it must be understood that Wormhole is a hypothetical tunnel, connecting two different points is space-time. So, a trip through the Wormhole could take much less time than a journey between the same starting and ending points in normal space-time. Take an example. First, consider the curvy aspect

of space time as the surface of an apple. Now, the wormholes in space are like the earthly Wormholes inside of the apple. Worms tunnel their way straight through from one surface of the apple to another, shortening the distance between the two points dramatically. This means, instead of walking on the surface of the apple, all the way from point A to the point B, one finds a shorter and much quicker path through the Wormhole that exists inside the apple, where destinations remain the same and the journey is faster. It is believed that the ends of a wormhole could be intra-universe (both ends that exists in the same Universe) or inter-universe (where one end lies in one while the other is the connecting to a new Universe).

Wormholes are tunnels with just one entry and exit which links different parts of space time continuum. It is believed that if both ends of wormhole are brought together with the aid of an electromagnetic or gravitational field, it will be possible to keep entering them and re-entering them and travel backwards and forwards in space-time. The classical physics of Newton and Einstein, however, suggests that, once entered, a wormhole is likely to slam shut immediately. But according to quantum physics, there are ways out, and one suggestion includes the traveler would need an anti-gravity device to exert negative pressure to counter gravity which will ensure the journey and safe return of the traveler. But many ideas and concepts regarding the traveling through time via wormholes are still in the hypothetical stage. Although using time travel to establish contact with extra-terrestrial civilization sounds fascinatingly interesting but the actuality of it is indeed very complicated and vastly difficult to exercise in respect of real time and space.

Now, getting back to the sending and receiving messages from other civilizations, it will not be too smart to think that all intelligent life forms have the technology to contact other planetary being via sophisticated machineries. It must be understood that interstellar space flight is time consuming and highly expensive even with the availability of resources for that purpose mainly due to complexity of

the nature of the travel. And this is the reason why mankind has resort to interstellar radio transmission for the search for extra-terrestrial intelligence. But then again radio communication process may end up completely useless upon the contact with alien life-forms that has no familiarity with technology of any kind. Many believe that there are life-forms within our very own solar system but we, Earthlings, seem to be only one to pose machineries to detect others through various educated means. But at the end of the day, considering the vast amount of space and time factor, radio is by far the best as radio telescopes are relatively inexpensive, the signals travel at the speed of light, which gives the signals an unmatchable speed. And the process can cover a vast amount of space, hence, a large part of the electromagnetic spectrum, and any technical civilization anywhere in the galaxy, given that they have discovered radio, just as we have, is likely to response somewhere in time.

With everything going on in this universe for billions and billions of years and with all the cosmic marvels, Earth is the only planet with intelligent life-forms, sounds really far fetched. If life can flourish on this solar system, then same cosmic event, by law, is bound to take somewhere else as well. Given that there are so many stars like our Sun, so many planets like our lifeless ones in our own solar systems, so many galaxies like our own Milky Way and with so many cosmic elements like pulsars, quasars, black holes, nebulae and so on, numbering confidently more than one, why Earth should be the only planet in this universe with life? If the universe can house so many components in numbering obviously more than one, then by that logic, there must be planets like Earth out there in the universe.

Future from the Beyond

Every beginning, sadly, has its end and our universe is no exception to that. There are many theories regarding how it will come to an end. One possible theory, amongst many, is the Big Crunch theory. And it states that one day in the future, our universe will not only stop expanding, but also reverse due to the immense pull of gravity and

eventually will collapse into itself and ultimately will turn into a super-hot, super-dense singularity. Some scientists even speculate that this collapse into an imaginably big black hole would eventually trigger another Big Bang (BB). Another theory suggests that there won't be any reverse pull like that of Big Crunch, instead, there will a Big Chill or Big Freeze where the Universe will slowly cool down as it expands until everything within it becomes absolutely barren and lifeless. And there is another theory which states that with the current way of expansion, there is a possibility of the Big Rip, where, being unable to bear such a rate of expansion, everything in this cosmos will be violently ripped apart in such a way as if it never existed. And with that demise, everything will cease to exist, perhaps until the next new beginning.

Even though when we look up at the sky, on a clear night and away from the cosmopolitan s luminous distractions, we see countless of stars, planets, galaxies and other splendors of this universe. But here is an astonishing fact. 72% of our known universe is covered with a force called Dark Energy which is an invisible cosmic phenomenon that mysteriously powers the accelerating expansion of the Universe. Of the rest, 24% is made up of "dark matter", which is also invisible but can be detected by its gravitational pull. And as for the rest of the universe, a measly 4% per cent is actually made up of the stuff that makes up people, planets, stars and everything that are made up of atoms. That s just how spectacularly vast this universe truly is.

And this 4% is in the particular interest of human research into the cosmos and it may seem quite a small amount but it will perhaps never be possible for human being to learn all and everything about this 4% of the universe. At the dawn of 3rd millennium, our perception of the universe has changed for better and many say we have graduated from the physical nature of the universe to the biological one. It is more important to realize that we like to see extra-terrestrials for what they are, not what we, the human beings would like them to be. We ourselves have come a long way from Earth being flat to the centre of universe fabrications. Our cosmic adventure has just begun and it will be nice to have some friendly company in the cosmic neighborhood. While many conspiracy theories concerning UFOs and aliens sound

fascinating and in fact are enjoyable readings, we simply cannot afford derive from logic and reason concerning man s quest for extra-terrestrial intelligence, tech savvy or not.

The quest for extra-terrestrials has just begun and there is a long way to go. And there is plenty of time for it as Earth will last for another 7.5 billion years or so before the Sun becomes a red giant, a stage in the decaying phase of a star like our Sun as it runs out of hydrogen at its core, the core collapses and the star begin fusing helium while hydrogen fusion transferred into the outer layers of the star. And eventually this process will reduce Earth s orbit and the entire planet will be engulfed by the Sun s massive heat, evaporating all the water from Earth, leaving the once flourishing blue planet into a pile of decayed molten life-less state. But in the mean time a lot can happen. And the discoveries of the present times are the testament of all that is to come. Pioneer 10 & 11, Voyager 1 & 2, these are some notable space probes that were launched in the last century in order to understand our universe better and as efforts to detect planets that are likely to host extra-terrestrial life-forms of some kind. On March 6th, 2009, NASA launched Kepler Spacecraft Telescope (KST), named after 17th century German astronomer extraordinaire, which was launched with the objective of discovering Earth-like planets orbiting other Suns in the constellations of Cygnus and Lyra. And as of January 2013, there is a staggering 2,740 planets that have been discovered by this satellite which are possible candidates as planets that are likely to host life. The search is on and science is leading the way. But before we get into to the science of things, let s take a look at the prelude to all the beginning that still feeds man s curiosity in the search for extra-terrestrial life-forms.

Chapter-2 (Religions, Ancient Astronauts, Histories, UFOs & E.Ts)

The Sacred Whispers

When did it all began; the true scientific quest towards the extra-terrestrial life-forms? Much before the scientific missions, did the religions of world have anything to say about that? What would be the history behind mankind s understanding towards our cosmic brethrens? The appeal of life on other planets is much older than we can imagine. Throughout the ages, great minds have dedicated their lives to shed some light on the age old question, Are we alone in the universe? It must be understood that concerns over extraterrestrial life forms are as much spiritual as they are scientific and while science has been determinedly searching for answers, many believe; religions, on the other hand, have long been pioneered in introducing mankind to their celestial neighbors. It is surely fascinating that all the major religions of the world explicitly revealed the notion of various cosmological entities and vibrantly mentioned that God s astro-biological creativity was never limited to only Earth. But one would also be mistaken by thinking that religions in their respective holy books present a concrete imagery of alien life forms because as experts say these books are not of Science but rather Signs and experts say, signs of celestial beings have always been there.

Referring our galaxy as Cakkavala, Buddha stated that the whole universe is the home of countless of galaxies; there subsists realms of existence unseen by the naked eye. In many of the Buddha's discourses there were always the mentions of beings from 10,000 world systems that gathered to listen to him. And comparing our world with those of the others, Buddha revealed that in our world alone there are 31 planes of existence and humans and animals are of those 2 planes that are visible to us and the rest such as spirits and other higher plane beings

remain unseen due to our limited vision. And as Buddhist cosmology conjectures numerous world systems, these same 31 planes of life forms also takes place in those realms of existence that are in other galaxies or universe. According to Hindu scriptures, there are innumerable universe created by God to facilitate the fulfillment of the separated desires of innumerable living entities and aside from these cosmoses, there is also the unlimited spiritual world, where the purified living entities live with perfect conception about life and ultimate reality. The Talmud, which is second only to the Hebrew Bible in importance to Jewish religion, states that there are at least 18,000 other worlds, however, it provides little details on the spiritual or physical nature of those mentioned worlds. But, based on this, the medieval exposition "Sefer HaB'rit" posits that extraterrestrial creatures exist even though some may possess intelligence but their ways are equivalent to that of animal life due to their lack of free will. It further adds that human beings should not expect creatures from another world to resemble earthly life, any more than sea creatures resemble land animals! In the same religion, in the song of Deborah, there is this verse, "Cursed is Meroz... cursed are its inhabitants" (Judges 5:23). In the Talmud, scholars found the opinion that Meroz is the name of a star and according to this opinion, the fact that Scripture states, "Cursed is Meroz... cursed are its inhabitants" is a clear proof from the words of our Sages for extraterrestrial life.

The Bible, on the other hand neither mentioned the existence of extra-terrestrials on other planets nor did it utterly dismissed the possibility of it. However, the following verses of Genesis are quite thought provoking, like The heavens and the earth (Genesis 1:1), He also made the stars (Genesis 1:16) and God s promises to Abraham to make his descendents As numerous as the stars in the sky and as the sand on the seashore (Genesis 22:17). Could these be a direct reference of the possible 100 billion stars in our galaxy amongst the 100 billion galaxies in the known universe, a knowledge that was acquired much later? According to the Gospel of John 10:16, Jesus

says, I have sheep that are not of this sheep pen which many believe could mean Non-Human intelligences amongst many possibilities. Mormons, who are a religious and cultural group related to Mormonism, the principal branch of the Latter Day Saint movement of Restorationist Christianity, believed, since 1830, that God has created and will create many Earth-like planets on which human being live. In the Biblical Old Testament, chapter 1 of the Book of Ezekiel recounts a vision in which Prophet Ezekiel sees an immense cloud that contains fire and emits lightning and brilliant light . This is how it is stated in the holy book: The center of the fire looked like glowing metal, and in the fire was what looked like four living creatures". These creatures are described as winged and humanoid and they sped back and forth like flashes of lightning" and "fire moved back and forth among the creatures . The passage further goes on to describe four shiny objects, each appearing "like a wheel intersecting a wheel" and those objects could fly and they moved with the creatures, as described When the living creatures moved, the wheels beside them moved; and when the living creatures rose from the ground, the wheels also rose .

Many consider that they are indications of alien life-forms and their spaceships. Many Christian theologians believe that the vastness of the universe means it is possible there could be other forms of life outside Earth, even intelligent ones and ruling out the existence of aliens would be like putting limits on God s creative freedom. Interestingly in 2008, a report came out in the BBC where Father Gabriel Funes, director of the Vatican Observatory near Rome who is a respected scientist who collaborates with universities around the world, said that intelligent beings created by God could exist in outer space. He also said that the search for forms of extraterrestrial life does not contradict belief in God. That is indeed quite a revolutionary thought considering Church s earlier stance on life on other planet issues, just even few hundreds years ago, which wasn t as liberal as it is today.

Also a perceptive stance on extra-terrestrials could be found in Islam as well. It is stated in The Holy Quran, verse 42:29 And among His signs is the creation of the heavens and the earth, and the living creatures that He has scattered through them and He has power to gather them together when He wills . According to experts this verse is of great significance as it not only clearly indicates existence of life is not limited to only Earth but also contains a prophesy that a time will indeed come in the future when humans will discover extraterrestrial intelligence. Besides the following verse of The Holy Quran All praise belongs to Allah, Lord of all the worlds, Holy Quran, 41:10 also shares the possibility of multiple bodies and even multiple universe where there could be both extraterrestrial and extra dimensional life-forms. Also in the Verse 65:12, Allah is He Who created seven Firmaments and of the Earth a similar number , many believe, this strongly states the possibility that there are six other planets like that of Earth besides ours, along side other possibilities. The Holy Quran also provides an insight of what nature the extraterrestrials would be like. The verses 19:93-96 states, Not one of the beings in the heavens and the earth but must come to (God) Most Gracious as a servant. He does take an account of them (all), and hath numbered them (all) exactly. And every one of them will come to Him singly on the Day of Judgment. On those who believe and work deeds of righteousness, will (God) Most Gracious bestow love." Experts believe that Holy Quran here is referring to the celestial beings of a level of development which makes them morally accountable beings, in other words organisms possessing intelligence and have the ability to formulate choices. Aside from extraterrestrial testimonies Holy Quran also cited the contemporary scientific marvels to the groundbreaking discoveries concerning cosmology. It is mentioned in Holy Quran, verse 55:33, "O ye assembly of Jinns and men! If it be ye can pass beyond the zones of the heavens and the earth, pass ye! Not without authority shall ye be able to pass! which many deem as direct reference of the modern day Space Shuttles and their voyagers in the space.

Now whether religions truly explained or prophesized on aspects of extra-terrestrial life-forms, well, that sure is a matter of great mystery, and perhaps a subject to a great debate. But throughout the ages, in many civilizations, researchers say there are references or hidden indications of life on distant planets. So much so, that many believe that those Intelligent biological beings from other terrestrial vicinities who can also be referred as Extra-terrestrial Biological Entities or EBEs, actually came down on Earth at some point and enhanced mankind s intellect and understanding towards their own selves and the way the universe works.

The Ancient Astronauts Theory

When it comes to the topic of extra-terrestrials, towards some unjustified extent, this subject matter is often referred as UFO incidents , mostly because of the popularization of the incidents that took place in the second half of 20th century especially after the 1947's famous Roswell incident. Although the belief and enthusiasm on this aspect surely skyrocketed in the later half of the previous century with hundreds of UFO sightings, alien abductions but many question whether the extra-terrestrial life-forms been visiting Earth for only these last 6/7 decades or so or since the ancient of times when this planet was formed 4.5 billion years ago?

There s been this idea that the visitation of the third kind have always been there and many claim there are evidences of it as well. And this leads us to the controversially popular Ancient astronauts theory, also known as paleo-contact theory the idea of which basically states that, there are numerous pieces of archeological evidences out there which are proof that this planet of ours was visited by intelligent beings from other planets who came here many, many seasons ago and made friendly contact with our ancestors to augment human civilization for good. The truth and logic in these will be discussed later but let s confer few examples that profoundly advocate, according to some, in the theory s favor.

As the modern day alien encounters are either photographed or captured on videos, many believe the testimonies of old encounters weren't much different either. Dated as old as 10,000 BC, cave painting found in Val Camonica, Italy, shows two extraterrestrial visitors or beings with the appearance of modern-day astronauts. Similar type of prehistoric artwork was found in Toro Muerte desert in Peru and a Petroglyph (ancient rock engravings) of such in Tassili n'Ajjer, the mountain range in the Algerian section of the Sahara Desert, was even nicknamed the Martian by the archeologists. A 29,000-year-old cave painting in Itolo, Tanzania, depicts objects which plainly have the looks of the modern day disc shape UFOs. Cave paintings of Pech Merle near Le Cabrerets, France, artwork that are estimated to be from 15,000 BC, show a landscape full of wildlife along with a number of saucer shaped objects. There is a 7000 year old rock carving in the province of Querto, Mexico, where four figures appear as their arms outstretched towards what seems to be a large oval object radiating beams of light. Some 5000 year old cave paintings near the Glenelg river region of Kimberley; Northern Australia shows a series of drawings of Wandjina, as they are referred by the Aborigines, which strikingly have the similar looks like that of Grey aliens, a kind of extra-terrestrial being that not only many of today's alien witnesses have claimed to have encountered but also similar to the alien beings that are thought to be captured during the UFO crash at Roswell in 1947! Somewhere along the Russo-Chinese border there is a cave painting which was painted around 2000 BCE which shows a space-suited figure holding a disc shaped object that appears to be a communication device and not only that the figure's helmet has two antennae on it and above it there is a flying saucer emitting a plume of smoke. In the last century a 4000 year old Lalladoff plate was recovered from Nepal which appears to shows a disc shaped UFO and the figure of that Grey alien entity. The most astonishing part is that many of these paintings and artworks were amongst the other ordinary everyday subject matter and this out of context depiction of these UFO's and alien beings by the cavemen

makes them highly interesting as why would they depict unordinary things like UFOs and alien beings amongst their everyday ordinary happenings and way of life. And many wonder, what would oblige the ancients of men to do that?

Few words on the mysterious Nazca Lines are in order as well. Nazca lines, constructed around 400 and 650 AD, hundreds of huge ground drawings sketched into the high desert of southern, some of which are stylized animals and humanoid figures, while others are merely straight lines hundreds of meters long. And all these figures can actually be seen from a great height from up above and that is why they have been linked with the ancient astronauts hypothesis. Some believe the Nazca lines and figures could have been made in accordance to the instructions from extra-terrestrial aircraft and there are suggestions that the longer and wider lines might be runways for such spacecraft. Many of such illustrations baffle the scientific communities and there is further evidence that many of our own ancient civilizations take a direct reference to extra-terrestrial beings in their religious and cultural aspects with exceptional command over the knowledge of the sky that was learnt just yesterday by the modern-day astronomers. One such is The Dogons, a tribe living in Mali, West Africa, who are known for their vast cosmic knowledge and sophisticated cultural life. According to their tribal folklore, the Dogons are the descendants of Nommos, a race of amphibious beings that resembled mermen and mermaids who came from a planet that orbits the star Sirius, the brightest one in the sky. Every half-century the Dogons perform a ritual where they celebrate this twin planet of Sirius which is known as Sirius B in the astronomical community today. The most amazing fact is, neither the Sirius B is visible to the naked eye nor back in the days the Dogon people did pose any necessary astronomical equipments to see it and the knowledge of the existence of this Sirius B planet was acquired by the scientific community only in 1978 whereas the Dogons knew of it in details for more than 1000 years! What is more interesting is that these Nommos

could also be traced back to other civilizations like that of Babylonian, Akkadian, Sumerian and Egyptian. And speaking of Egypt, the mystery that still shrouds in every aspect concerning the construction of her great Giza Pyramids which are often linked with Extra-terrestrial interventions after all the great ancient Egyptian god, Ra, had been known to ride across the sky in a fiery chariot which, many say, very well could have been an extra-terrestrial vessel! And in Hindu religion, the Hindu Gods Indra and Bhima were believed to be roamed through the heavens in fiery ships. There is another idea amongst experts in this field, most notably by Azerbaijani-born American author Zecharia Sitchin, which states that the gods of ancient Mesopotamia were actually astronauts from the planet Nibiru , a celestial object in our solar system which many claim that the olden Sumerians believed to be a remote "12th planet" (counting the Sun, Moon, and Pluto as planets) associated with the Sun god Marduk. This planet Nibiru which is scientifically believed to be a mythical planet, according to the ancients, continues to orbit our sun on a 3,600-year elongated orbit, a fact that modern astronomy is yet to verify. There are some hieroglyphics on the ceiling of the Temple of Abydos in Egypt which was built about 5000 years ago that shows images that appears to resemble modern military technology like helicopter, submarine, gunboat, plane and a fighter jet and a Sub machine gun. The heroes of Celtic myth like Chuchulain of Ireland were known to have weapons that had striking similarities of modern day missiles and tanks. In Vedic literature there are references to Vimanas (Sanskrit word for aircraft) as well as nuclear weapons. Researchers are mystified on the hints of such contemporary equipments in the relics of ancients of civilizations when all of these technologies were actually engineered merely in between the last 150 years. Many ancient monuments like the Giza Pyramids, Machu Picchu in Peru, Moai of Easter Island, Stonehenge of England, the pyramids of Latin America are often linked with advanced alien civilization because there is a belief that these massive stone structures were impossible to build by

the primitive indigenous people with their prehistoric tools of that time, despite having the imagination to illustrate them.

When it comes to explaining these mysterious strings of events and establishments, astrophysicist I.S Shklovski and Carl Sagan in their 1966 book Intelligent life in the Universe argued that scientists and historians need to consider seriously on the possibility of extraterrestrial contacts during the recorded history of mankind which are thought to be noted in the pre-scientific narratives. But perhaps the most authoritarian work on this regard is the work of Swiss author Erich von Daniken who in his worldwide bestseller book Chariots of Gods: Unsolved mysteries of the past presented the evidence that alien visitation did take place on Earth in the ancient times. Daniken along with his fellow Ancient astronauts enthusiasts explain that at the dawn of great civilizations like Egypt, Maya and the ancient Chinese, the primitive people of these regions were visited by some extra-terrestrial race who basically commenced their process of civilization in the world and matured the human evolution as the heavenly beings shared their knowledge with mankind and the later often mistook these beings as Gods and angels! Much to that extent Alan and Sally Landsburg, in their 1974 book In search of Ancient Mysteries which was basically an extension of the television program with the same title, strongly speculated that not only extraterrestrials visited this planet, but also they established bases here at intervals of thousands of years, giving mankind gifts of knowledge and augmented human civilization in the process.

UFO s in Medieval Paintings

There are some paintings made during the Middle Ages, where it was later discovered in the 20th century that, in certain locations of the paintings, there are what appears to be drawing of structures of what we today refer as UFOs. The UFOs in those painting, illustrated by the European masters, are always floating above in the sky and usually located above the Virgin Mary or above Jesus Christ on the crucifix, since crucifixion is the central in many of the paintings of that era.

Some of the most notable paintings in this regard are Carlo Crivelli s Annunciation in 1486, Paolo Uccello s Scenes of Monastic Life in 1460 and Sebastinio Mianardi s 15th century creation Madonna and Child with the Infant Saint John . Even though the whole idea that medieval paintings depicted UFOs gained quite a following after an article appeared on this in the French magazine Spoutnik in 1964, but according to professionals who study art and art history, these UFOs are nothing but symbolic representation of Sun and Moon which were subject to constant illustration, often aided with human characteristics, like face and other times with full bodies. According to experts, the concept of representing the sun and the moon with human characteristics was a carry-over from the traditional pagan artwork of Rome. The Roman Catholic Church simply continued that custom of symbolizing the sun and the moon with human characteristics in the artwork that it had commissioned. The sun and the moon are usually facing the cross, which is supposed to represent them being witnesses to the crucifixion of Jesus Christ. According to James Hall, author of the Dictionary of Subjects & Symbols in Art , the sun and moon, one on each side of the cross, are a regular feature of medieval crucifixion paintings. They survived into the early Renaissance but are seldom seen after the 15th century. Their origin is very ancient. It was the custom to represent the Sun and Moon in images of the pagan sun gods of Persia and Greece, a practice that was carried over into Roman times on coins depicting the emperors .

Ancient Astronauts or Ancient Archeology?

Now the question is, whether there is any absolute truth in the ancient astronauts theory? Did beings from distant planets actually came down on Earth at some point in human civilization and stayed here for a while, taught mankind ways of the world and then disappeared, leaving some relics that still stand today as testaments to their visit here on Earth? The fact is, as much interesting and fascinating the ancient astronauts and other related theories sound, perhaps to the larger extent they systematically undermine the achievement of our

ancient of civilization which those olden people earned with great intellect and tremendous hard work. So far there haven t been any definitive scientific findings which absolutely proofs that these ancient relics are actually extra-terrestrial in origin or they indeed have some sort of association with some distant planetary beings. In fact any speculation that their achievements are not their original work rather the result of the teachings of some strange little green men is very wounding to the capabilities of human intelligence and his devotion towards greatness. It must be understood that our ancestors were smart, intelligent and probably way wiser than the people of the world today. By combining intelligence, determination and hard work, our ancestors came up with some spectacular creations throughout the ages, many of which still robustly echo their marvelous ability to prosper and progress as people. It is interesting to note that most of these supposed ancient astronauts cases, if we consider their locale, we will see, largely they are from non-European countries. This also has led to another assumption that, ancient astronauts theory was specifically developed to undermine the stellar woks of ancient civilizations from the continents of Africa, South America and Asia who were far more advanced and progressed than their European counterparts.

Many have stated that it will be a great mistake if we question the abilities of our ancestors to develop their own myths, arts, architecture, social organizations, etc. It will not be right to question, in this way, ancient people s capacity for culture and civilization itself. If the prehistoric humans did not develop their own arts and technologies, but rather were taught art and science by visitors from outer space, then how we came to experience such unique progress as mankind, in all aspects of life? We bettered today because efforts towards such were always there. We came a long way and it was possible simply because we always had the thirst and determination as well as the intellect to develop. The massive pyramids were the example of pure human calibers just as modern effort to send satellites into space is. There are plenty of evidences that the prehistoric or primitive

peoples were quite intelligent and resourceful. There is always this possibility that visitors from outer space did land on earth a few thousand years ago and communicate with our ancestors. But it seems more likely that prehistoric peoples themselves were actually responsible for their own art, technology and culture. And even if there is, at present no explanation regarding how some particular prehistoric achievements were made by the ancient people there is, in fact, another and much more likely possibility in this regard and that is that the ancient people did it themselves using means and procedures whose exact natures are no longer present in the historical record.

It must be understood that even though we are yet to comprehend how the ancients accomplished some of their more astounding physical and technological feats like how the ancient Egyptians raised giant obelisks in the desert, how stone age men and women moved huge cut stones and placed them in position in dolmens and passage graves and how the giant carved heads on Easter Island and wonder why they were done, who did them, and why they abandoned the place and so on. But someday we are likely to find the answers to those epic questions of ours and it is best that we find the answers with the aid of through scientific investigations not pseudoscientific speculation. Many critics of this ancient astronauts theory argue that any gaps in contemporary knowledge of the past do not demonstrate that such speculative ideas like little green men came from distant planet and augmented mankind s progress are a necessary, or even reasonable. It has been found on numerous occasions that a number of ancient astronauts claims are made in direct opposition to the consensus scientific interpretation of evidence and to legitimate scientific explanations. The truth is, after few decades of continuous hype, the scientific community remains generally skeptical, and the dominant view is that there is no actual evidence to support ancient astronauts and paleo-contact theories. But surely they make great readings though.

The search and understanding towards life in other worlds is very different than the all out gusto on ancient astronaut s theory factor. It is

clearly understandable the dreamy appeal of alien beings coming down on Earth and leaving their mark among Earthlings and the locales that hey inhabited. But the quest towards life as well as civilizations on distant planets requires more seriousness than blatant romanticism in this very crucial aspect of our time. There is no harm in researching on such phenomenal claims but at the end of the day, we must remember, if we are to surely look for clues on extra-terrestrial issues, we are to put more emphasis on looking at the skies and the stars instead of digging ancient archeological sites.

UFOs themselves

Just with the topic of UFO and issues that are directly associated with it, this book can be filled entirely with UFO related events, such is the vastness of the UFO linked activities that took place in the span of just last few decades of mankind s existence. But, what is UFO at the first place? To be simple, UFO or Unidentified Flying Object is any apparent anomaly in the sky or near or on the ground, but observed hovering, landing, or departing into the sky that is not readily identifiable as any known aerial object or phenomenon by visual observation or any other method such as radar. And it all began on June 24, 1947 when a civilian pilot named Kenneth Arnold reported seeing nine objects flying in formation near Mount Rainer, Seattle and the young pilot described these flying objects shape as being somewhat disc-like or saucer-like which lead to the newspaper terming these unidentified flying objects as flying saucers , hence the nick name for all UFOs. But the very term UFO was first coined by Capt. Edward J. Ruppelt, who was in charge of Project Blue Book which was a series of systematic studies of UFOs conducted by the United States Air Force that started in 1952 and ended in 1970. And that s the history of how the whole business of UFO or Flying Saucers started at the first place. But on January 25, 1878, there was a report in the Daily News, a news paper in Denison which stated that one John Martin, a local farmer, had seen a large, dark, circular object resembling a balloon flying at wonderful speed which appeared to be about the

size of a saucer. And many also believe this is the very first known use of the word "saucer" in association with a UFO. Another one of the earliest UFO related phenomena took place back in February 28, 1904, where there was a sighting by three crew members on the USS Supply which was stationed 300 miles west of San Francisco. The whole incident was reported by Lt. Frank Schofield who later to become Commander-in-Chief of the Pacific Battle Fleet. The Navy man wrote that three bright red egg-shaped and circular objects flying in echelon formation that approached beneath the cloud layer, then changed course and soared above the clouds, departing directly away from the earth after two to three minutes. According to him the largest had an apparent size of about six suns. Since then millions of UFO sightings have been reported and UFO and extra-terrestrials concept have enjoyed a healthy a synonymous relationship. And of all UFO related activities one that truly took the legendary shape was the Roswell UFO incident that took on July 7th, 1947 where it is believed that an airborne object, extra-terrestrial in origin with alien life on board, crashed near Roswell, New Mexico.

There are countless of UFO related incidents but more on the UFOs, which is integral in the understanding of extra-terrestrial life-forms, in the context of modern day and age, will be discussed later along with many other theories and concepts that are robustly associated with UFOs and their possible visitations on planet Earth. But before further discussion in this regard, let s talk about a fascinating UFO incident which pretty much covers all aspects of modern-day UFO related extra-terrestrial phenomena, from UFO sighting, to alien abduction to astonishing government conspiracies.

It all began with the abductions of Barney and Betty Hill, who, many believe were the very first well-documented alien abductees. On the night of September 19, 1961, the 39-year old mailman and 41-year old child-welfare worker were returning home to Portsmouth, New Hampshire after a vacation from Southern Canada. Amongst many strange occurrences that the couple experienced on that bizarre night,

one incident stood out. They had absolutely no recollection of two particular hours of their journey home, equivalent to a 35 mile long drive! Puzzled and petrified, the couple decided to go through regression hypnosis (psychotherapeutic process in which the patient returns to an earlier stage of life in order to explore a memory or to get in touch with some difficult-to-access aspect of their personality-psychology which only revealed the striking details of their abductions. Under hypnosis, Betty drew a star map which she claimed to have been shown to her by an alien entity sometime while she was abducted and confined briefly for those two hours in the alien spacecraft with her husband. This star map showed all the star systems that the celestial beings had visited during their space expeditions. Now, skeptics will have their say but from this point on this is where the story becomes uniquely interesting from an astronomical point of view. Seven years later in 1968 Marjorie Fish, an amateur astronomer after studying thousands of vantage points for years concluded that the alien entities that abducted the Hills were from a planet orbiting Zeta2 Reticuli! It is known that Zeta Reticuli, a binary star system (two yellow-orange stars like our Sun namely Zeta1 Reticuli and Zeta2 Reticuli), is located 39 light years away from Earth is a strong candidate which many Ufologists (people who are academically interested in the study of UFOs) strongly believe to be housing an extra-terrestrial civilization.

It does sound like a modern-day urban legend but a few aspects of the incident remain mysterious. For starters neither of the Hills had prior knowledge of astronomy, certainly not enough to understand the rotation of the distant star systems. It wasn't until 1969 when Gliese catalog came out that the stellar map of that region became familiar to ordinary people. How did Betty Hill know the exact position of the planets which are barely visible to the naked eye? Besides, the star map that she drew had all the stars connected by lines which Betty said were frequently traveled routes by the alien entities where Zeta Reticuli star system was the hub. Ufologists now also think that for a

civilization located some where around Zeta Reticuli, Betty Hill's drawn line-routes would be most logical way of exploring the nearby stellar neighborhood. Now how did she know that? Some might say this is nothing but another E.T hoax cooked up by two bored middle-aged people indulged by the wild imagination of an amateur astronomer. But the fact is the Hills are considered historically significant by both UFO enthusiasts and debunkers alike as far as alien-human contact is concerned. And concerning Marjorie Fish's findings, experts believe that Fish's explanation of the Hill map indicate the Reticulian system where the ages of the stars are 1 to 3 billion years older than our own. And this suggests the possibility that this would have permitted another terrestrial race of higher intelligence to evolve in another planet long before the human civilization dawned on planet Earth.

The appeal of stars Zeta1 and Zeta2 is intriguing as these two are among the top priorities of NASA's Terrestrial Planet Finder (TPF) which is due in sometime between 2014 and 2020. But it is the mysteries that are constantly associated with Zeta Reticuli that makes this star system truly an enigmatic one. Bob Lazar, the first man to acknowledge the existence of a UFO research facility in Area 51, stated in 1988 that nine Flying Saucers are kept in the facility where he was employed as a scientist to help reverse-engineer them. According to Lazar these were originally from the 4th planet of the Zeta2 Reticuli solar system!

But it is perhaps Project Serpo that is the most mystifying of all as it involves human expedition to the Zeta Reticuli solar system and it all began with the famous UFO crash of Roswell. The story goes that one alien being survived from the Roswell crash and was courteously detained by the US forces. And as some form of trust and communication was established the celestial being said that it was from a planet from the Zeta Reticuli solar system and was allowed to communicate to its home planet via a communication device that survived the crash. In 1962 a secret human astronauts and alien

exchange program (titled Project Serpo) was developed with the consent of that planet and in 1965, 12 human astronauts left for that planet via a new alien spacecraft which left a new alien being as previously agreed. The story goes on to say that the human astronauts stayed in the alien home planet from 1965 to 1978 and 8 returned as two died and two decided to remain on the alien planet. It is alleged that the astronauts upon returning home wrote a 3000 page report detailing their stay and way of life in the planet of the two suns!

The extent of truth in these claims may never be verified. But the closest to authenticity one could get is perhaps from the cinema maestro Steven Spielberg's creation Close Encounters of the Third Kind . The movie depicts an alien ship landing by prearrangement with the US government and an ambassadorial exchange takes place where a single alien disembarks and is escorted away by humans while 12 astronauts walk into the alien spacecraft on a journey to a distant planet inhabited by an extra-terrestrial race! The movie was released in 1977 and is considered by UFO enthusiasts as the testimony of what truly happened in 1965. As for Spielberg's view in this matter, in his own words, I really found my faith when I learned that the government was opposed to the film. If NASA took the time to write me a twenty-page letter, then I knew there must be something happening .

Now are all UFOs, extra-terrestrial in origin or they are man made or just an illusion of some actual natural phenomena? Some words are in order regarding this. Research has found out that a great majority of UFO reports were misapprehended, most of which, to begin with, were, unconventional or experimental aircraft developed by the technological advanced nations, automobile headlights reflected off overcast, balloons, birds, luminescent insects, even planets and stars seen under unusual atmospheric conditions to other astronomical objects like comets, bright meteors, planetary conjunctions, or atmospheric optical phenomena such as Parhelia, atmospheric phenomenon that creates bright spots of light in the sky, often on a

luminous ring or on either side of the lenticular clouds (stationary lens-shaped clouds that form at high altitudes, normally in perpendicular alignment to the wind direction). But it must be understood that even though some UFO phenomena can be explained while many others, to this day, remains unsolved. Indeed many governments or independent academics in the United States, Canada, the United Kingdom, Japan, Peru, France, Belgium, Sweden, Brazil, Chile, Uruguay, Mexico, Spain, and the Soviet Union have investigated UFO reports at various times. And so far no official government investigation has ever publicly concluded that UFOs are indisputably real, physical objects, extraterrestrial in origin and most government studies have established that the majority of UFO observations are misidentified conventional objects or natural phenomena, most commonly aircraft, balloons, different forms of clouds or astronomical objects with a small percentage even being hoaxes. But a great portion of the civilians of the world also believe that the governments are lying which is why UFO s are a mainstream element in the conspiracy theories which argue that governments are allegedly intentionally covering up the existence of UFO s and aliens by removing physical evidence of their presence here on Earth and in some occasions even collaborate with extraterrestrial beings, much like the Project Serpo. One of the strong arguments in favor of UFOs is that these flying objects appear to display flight characteristics that are seemingly not only impossible for modern conventional aerial technologies to execute but also impossible for human beings to endure the flying patterns, both physically and psychologically, hence the conclusion is that they must not be from Earth!

From military significance to popular culture, UFOs, over the past few decades, have gained a cult following, both from scientific as well as amateur communities. Now, as for their authenticity, well some UFO sightings are indeed absolutely explainable whereas many of them are mysterious and remained unexplained to this very day. But one aspect that needs to be addressed and be taken with great deal of importance

is that UFOs and extra-terrestrials are not necessarily the same thing. Even though people tend to associate UFOs with extra-terrestrials and often times there are strong reasons to be but UFOs are simply aerial crafts that are not identified to be recognized with any conventional ones whereas extra-terrestrials are life-forms from another planet. It must be understood that all UFO matters are not extra-terrestrial in origin since many governments, for defense related purposes, secretly experiment with aircrafts that are not conventional military planes. It has been seen that many times, that, genuine interest in extra-terrestrial matters got overshadowed with over enthusiasm in UFO matters. While both subject matters of great interest to people who are devoted to the search and understanding towards life on different planets but each require their very own distinct kind intellectual investment and it will never be wise to mingle the two on every single occasion. UFOs are of technological wonders whereas extra-terrestrials are biological ones. All things extra-terrestrials can be of UFOs but not all UFOs are not of extra-terrestrials.

The Search for Extra-Terrestrial Life: The Beginnings

The history of the intelligent human interest in life on different planets and the possibility of the existence of Earth like planets in universe are quite old. Many of our greatest minds have devoted their introspective thoughts on the subject matter. One of the earliest scholars to raise the issue was Greek philosopher Democritus (Born 460 and died on 370 BC) who was also an Atomist, an ancient concept which states that simple, minute, indivisible, and indestructible particles are the basic components of the entire universe. It was Democritus who speculated on the possibility of an existence of infinity of worlds or rather a plurality of worlds where there are an infinite number of worlds all with inhabitants like us. In 4th century BC, his ideas were shared by another Greek philosopher named Epicurus who was believed to be also an atomist and he further hypothesized that the motions of infinity of atoms would produce an unlimited number of worlds. The Roman poet and philosopher Lucretius (born 99 BC and died 55 BC) in his

poem De rerum naturae (On the Nature of Things) theorized the existence of other worlds based on the idea of the uniformity of nature and a revolutionary idea called principle of plentitude which states that asserts that everything that can happen will happen eventually. This means that if life can happen here on Earth it is likely that same will happen else where as well. Many even believed that life existed on our satellite Moon. For example, first century Greek historian, biographer and essayist Plutarch in his De Facie Orbe Lunae (Regarding the face of the Moon s Disk) discussed on the habitability of Moon and wondered whether the satellite s lack of clouds and rain means the planet is intolerably dry. He also believed that the universe is triangular with 60 worlds on each side and one at each apex, making a total of 183 worlds with each having their own inhabitants! The Pre-Socratic Greek philosopher Anaxagoras (born 500 BC, Died 480 BC) also believed the moon was inhabited. But these pluralistic world theories endured a hiatus chiefly because of Aristotle s treatise De Caelo (On the Heavens) which argued for the existence of only one world. The idea was just as a circle can have only one centre and one circumference, so the universe must have only one centre if it is to be an ordered whole, hence, the Earth centric universe point of view, a concept that has been proven wrong. For a while the pluralistic world view went into the shadows as it was rejected by Hippolytus of Rome, considered as 3rd Century AD s most influential theologian of the Christian Church and later by Roman historian and Christian Polemicist named Eusebius of Caesarea. Augustine, born 354 AD and died in 430 AD, also known as St Augustine who was a Father of the Church and whose writings are considered very influential in the development of Western Christianity, also rejected the speculations of Epicurus on the possibility of life on other planets in his book eleven of the City of God. One of the key reasons why such array of rejection of the atomistic philosophies of Democritus and Epicurus is because they were seen to be inconsistent with the biblical doctrines of creation and divine providence and considered essentially Atheistical in character.

But in between the idea that life on other planet could exist bounced here and there form time to time. The 13th century Chinese philosopher Teng Mu who was a scholar in the Sung Dynasty once wrote How unreasonable it would be to suppose that, besides the Earth and the sky which we can see, there are no other skies and no other Earths . A 13th century German Dominican friar and bishop named Albertus Magnus along with an esteemed student of his named Thomas Aquinas, discussed the question of the existence of other worlds in the light of Aristotle s arguments. It is believed that Albertus went even so far as to say that the issue of the plurality of worlds was one of the most wondrous and noble questions in Nature . The 15th century French philosopher and theologian William Vorilong is believed to be the first Christian theologian to explicitly relate the issue of other worlds to the doctrines of original sin and the atonement. Vorilong suggested that God, in his omnipotence, could actually have made infinity of worlds. Vorilong actually went further, however, when he stated that other beings on these worlds, if they existed, though created by God, would not share Adam s fallen nature.

With the establishment of Copernican heliocentric point of view a change slowly started to occur where the possibility of life on other planets gained, gradually, acceptance. But it came with a price. In 16th century, an Italian philosopher named Giordano Bruno placed his point that there ought to be an infinite universe in which every star is surrounded by its own planetary system, much like ours and that the other worlds are no different than ours and like Earth contains biological beings that flourished into civilizations. And this idea of his caused a great deal of upset amongst the Roman authority of that time and eventually a Roman Inquisition found him guilty of heresy, he was burned at the stake on February 17th, 1600 AD. After his death he gained considerable fame, particularly among 19th- and early 20th-century commentators who, focusing on his astronomical beliefs, regarded him as a martyr for free thought and modern scientific ideas. French author Bernard Le Bovier de Fontenelle, whom another French

writer, philosopher and historian, Voltaire termed as the most universal genius that the age of Louis XIV has produced , in his 1686 book Conversations on the Plurality of Worlds expressed on the possibility of extraterrestrial life, an idea which he believed light ups the creative sphere of a Maker. It is believed that Fontenelle s this writing influenced the 18th century Russian scientist Mikhail Vasilyevich Lomonosov, who discovered the atmospheres of Venus, to pen down his scientific interest in life on other planets as a reflection to his personal belief that there are indeed many inhabited worlds out there in the universe. Then around 19th century people started to take great interest on the possibility of life on Mars, mostly due to the belief that that a vast network of canals on Mars had been observed. As an extension to this hype, in 1895, American astronomer Percival Lowell published his book Mars, followed by Mars and its Canals in 1906, proposing that the canals were the work of a long-gone civilization. This idea further led British writer H. G. Wells to write The War of the Worlds in 1897, telling of an invasion by aliens from Mars who were fleeing the planet's desiccation. In 1938, a radio drama version of Well s this particular novel in the CBS Radio Network had such authenticity that many listeners believed that actual Martians landed here on Earth and were carrying out their invasion as the novel narrated!

Since then mankind sure has come a long way in his efforts towards understanding the possibilities of life on other planets. From reasonable speculations to the space explorations of 20th century, our knowledge concerning how the heavens work have expanded and bettered. We sent man in the moon throughout 1960 s and launched satellites in numerous planetary entities within our own solar systems and beyond. We have learned a lot and also realized that we have learned very little at the same time, given our minuscule existence in these vast regions of space and time. Passionately, our interest in cosmos grew. We realize that our universe is playhouse of wonder and every now and then we are schooled by incredible cosmic creations,

one after another. Also every now and then we also try to come up with an idea that would single handedly sum up all affairs of the universe once and for all, including that of extra-terrestrials. In the ancient time it was the Earth, Wind, Fire and Water theory, also known as the classical element theory which the ancients believed to reflect the simplest essential parts and principles of which anything consists or upon which the constitution and fundamental powers of anything are based. But that was an olden theory that is somewhat incompetent with the present-day context in the arena of scientific discoveries and ways of unearthing mysteries of the cosmos. And since then we have also developed a more precise approach towards how we are to view the universe and what this universe is all about at the first place. One such approach is the M-theory, which is basically the theory of everything. In non-technical terms, M-theory presents an idea about the basic substance of the universe. M-theory was developed in 1995 by physicist Edward Witten. It is actually the unifying theory of superstrings. And superstring theory states that particles, previously thought of as tiny balls of energy, are in fact minute wiggling strings. The most appealing factor concerning M-theory, which according to Prof. Stephen Hawking, is the only candidate for a complete theory of the universe, is that it has 11 space-time dimensions, not 10, as previously thought.

The M-theory states that, space-time has ten space dimensions and one time dimension and firmly advances the idea that 7 of the dimensions are curled up so small that we don't even notice them which leaves us with the illusion that, there exist only 3 dimensions, the ones that we are familiar with today. Also according to M-theory, in this 11th dimension, a string could acquire enough energy to expand infinitely into what scientists refer as floating membrane. In physics, membrane is a two-dimensional entity assumed as a fundamental constituent of matter in superstring theories of particle physics. It is understood that our universe exists on a floating membrane, along with infinite parallel Universe on their own membranes. From this foundation, it was further

discovered that (mathematically) gravity might "leak" into our membrane from another nearby membrane, accounting for its relatively weak force in comparison to the other forces. Experts believe, perhaps it is here that lays the connectivity that M-theory talks about which allowed this idea to succeed in unifying all forces in the universe with one, elegant theory, the M-theory. But nobody's still sure as further research is in order in this regard. Aside from this, with additional study, M-theory also provided another crucial bit of information regarding how the phenomena of Big Bang might have occurred at the first place. And the answer is with two membranes colliding. And according to this very theory, there lies about 10500 different universes, each with its own set of laws! And within these universes, there are intelligent beings, much like us.

Maybe someday, hopefully in the near future, we will come in contact with these planetary beings from distant locales of the universe and build a friendly cosmic neighborly relationship. The search is on. The modern-day endeavors in search of extra-terrestrial intelligence and other planetary biological life-forms will be discussed later in the book but it is clear that, our most brilliant of minds for thousands of years have pondered over the biological uniqueness of Earth and stressed on the magical possibilities of Earth-like planets with intelligent creatures on them. Many have looked at distant stars and galaxies while many have speculated on the possibilities of alien life-forms even within our very own solar system. The truth is both locales of our known cosmos hold great deal of mystery as well as promise for us in this regard. While the distant galaxies are quite the light years away, let s take a look at our own solar system; see if anybody is out there to accompany us in this cosmic search of ours for all that is truth, intelligent and biological.

Chapter-3 (Echoes from our Solar District)

The Story So Far

What has been learned, so far, about our own solar system concerning the possibilities of hosting life-forms is this following: There are chances that life existed, once, elsewhere in this 4.6 billion years old solar system of ours along side Earth, just as there is a possibility that extra-terrestrial life may continue to exist in other planetary objects that revolve around this much ordinary Sun of ours. Our Solar System, by the way, enjoys no privileged position in the Universe as it is ordinarily located in one ordinary locale s of the Milky Way galaxy, one of her outer arms to be precise in fact, a galaxy that houses about 200 billions stars, where many have their own solar system, much like our very own Sun.

The Water Worlds...

Before we investigate further on this matter, for the better understanding of the topic; let us comprehend a very crucial matter concerning an essential cosmic prerequisite for the development of life on planets at the first place. Life, why would it evolve on a planet? What is the geo-cosmic requisite for that? The simplest answer is the availability of water. It s not just for poetic purposes that water is compared to life itself. This tasteless, odorless and transparent liquid is the key reason why life has thrived here on Earth in the first place and still continues to survive. Even though it is believed that water may exist in abundance in planets in other galaxies too, mainly due to its components, hydrogen and oxygen, which are among the most abundant elements in the universe but as far as our planet is concerned, Earth is privileged to have 71% of her surface covered with water. But here, unfortunately saltwater oceans hold 97% of surface water and glaciers and polar ice caps account for 2.4% while only 0.6% of surface water is stored in rivers, lakes and ponds which have been the key sources of human survival for generations. But for our present

discussion we are more focused on the possibility of water on other planets.

Concerning this availability of liquid water on planets, we often hear about astronomers discovering new planets within the goldilocks zone. But what is this goldilocks zone (GZ) and why would any news of sighting a planet within the vicinity of GZ be interesting? In astronomy, goldilocks zone is the habitable zone around a star where a planet or several planets with enough atmospheric pressure are able to maintain liquid water on their surface without the water neither being completely vaporized or frozen. And the existence of liquid water, as we all understand, ultimately signals the presence of life. One good example of a planet located in such goldilocks zone is our Earth. The distance from our Sun to the Earth that we live on is just right where water is neither too cold (like Mars) nor too hot (like Venus) and thus the planetary atmospheric and environmental condition is just perfect to sustain carbon-based life forms, which eventually evolved into intelligent life. Regarding carbon-based life forms, scientists also argue that it doesn't necessary have to be a carbon based life form, some astronomers are suggesting that there might be ammonia and methane based life forms on other parts of the Universe. It is important here to note that the Earth's almost circular orbit keeps it firmly within the GZ at all times, but if a planet orbits covering much wider distance going into and out of the goldilocks zone during the course of orbiting, then it is incapable of supporting life. But it is within the goldilocks zone where other Earth-like planets could be found with the great possibility of an intelligent alien life form in other solar systems.

So far quite a few planets have been discovered that are thought to exist, at one time or another, within the vicinity of GZ. Some of these include, Gliese 581 C & D, moons of 16 Cygni Bb, moons of the gas giants Gliese 876 b & c, watery clouds and moons of Upsilon Andromedae d, satellites of another gas giant HD 28185 b, moons of a Jupiter-like gas giant 55 Cancri f, the planet HD 85512 b, which is one of the best candidates to host alien life so far, Kepler-22b which is a

super Earth planet meaning it is 2.4 times the size of Earth, GJ 667Cc which is also a gas giant that is believe to be in GZ. According to scientists, within a 1000 light years of Earth, there ought to be at least 30,000 habitable worlds. Scientists believe that given that there are at lease 50 billion planets in the Milky Way alone, there should be at least 500 million in the goldilocks zone.

Solar System: A very brief Tour

Anyway, enough talk about goldilocks zone but it is unanimously understood that only Earth is settled in at the GZ of our solar system which is why life developed here at the first place. And now getting back to life on our solar system but before that let us first understand few quick facts about our own solar system.

Located in the galaxy Milky Way and formed about 4.6 billion years ago, from the gravitational collapse of a giant molecular cloud of gas (mostly made of Hydrogen), this ancient system has a planetary structure of eight planets and various secondary bodies like dwarf planets and other small cosmic objects that orbit our Sun directly. It is understood that long, long time ago when the gas came together, it began to spin, which resulted in the Sun being centered at the middle, surrounded by an accretion disk of gas and dust and eventually in time, all the planets and other material in the Solar System formed within this rotating disk with a few exceptions like Halley s Comet. Previously our solar system used to consist of 9 planets but Pluto was reclassified as a dwarf planet in 2006 by the International Astronomical Union. And that s because in order to be qualified as a planet, an object needs to orbit the Sun, have enough mass to pull itself into a spherical shape, and must clear out its orbit of other material. And it s this third requirement that Pluto hasn t fulfilled; it s just a fraction of the mass in its orbit, while the other planets are millions of times more massive than everything else in their orbits.

Amongst the planets, the four smaller ones, Mercury, Venus, Earth and Mars are called terrestrial planets which are chiefly composed of

silicate rock and metal. The four outer planets are Gas Giants which means that they are mostly composed of various gases. For example, two of the largest Gas Giants are Jupiter and Saturn which are made mainly of hydrogen and helium. And the two outermost planets Uranus and Neptune are composed of mostly ices with shallow hydrogen atmospheres and have slighter and less hydrogen or helium than Jupiter & Saturn. And since they are mostly ices without deep hydrogen mantles, Uranus and Neptune are often called Ice Giants, to distinguish them from the Gas Giants, Jupiter and Saturn. The Solar System also contains locales populated by smaller objects like the asteroid belt, which lies between Mars and Jupiter and mostly composed of rock and metal, like that of terrestrial planets. And beyond Neptune's orbit lies the Kuiper belt (a region of the system located beyond the planets) the connected matters of trans-Neptunian objects composed mostly of ices (objects in the solar system that orbit the Sun at a greater average distance than Neptune). Within these cosmic objects there are several dozens to up to more than ten thousand objects that may be large enough to have been rounded by their own force of gravity and they are referred as dwarf planets. Dwarf planets are objects that orbit the Sun and have enough mass to form a sphere, but they share their orbit with other objects. Some of the identified dwarf planets include the asteroid, Makemake and the trans-Neptunian objects. In addition to these all, several other small-body celestial matters including comets, centaurs (meaning minor planets) and interplanetary dust freely travel between regions. Also six of the planets, at least three of the dwarf planets, and many of the smaller bodies are orbited by natural satellites, usually referred as moons after Earth's. And that s pretty much a brief understanding of what lies in the midst of our solar system.

The Red Planet

Now getting back to the possibility of life within our Solar System, amongst all the cosmic objects that make up our Solar System, it is the planet Mars that always remained the foremost contender in this grand

argument. Mars, also known as the Red Planet, has always captivated people s imagination as well as expectation as far as extra-terrestrial liquid and life-forms are concerned. And it all began back in 1877 when an Italian astronomer named Giovanni Schiaparelli observed straight channels on the surface of Mars and later produced the first detailed map of the planet where he referred those channels as Canali, which is basically Italian for long straight lines. But many misread the word Canali, and pretty soon the word Canal replaced it as a result of eager but honest mistranslation. And the speculation about life on Mars steadily commenced in the later part of the 19th century following the early telescopic observations of these apparent Martian canals . At that period of time American astronomer Percival Lowell wrote two books called Mars and Mars and its Canals where he sincerely proposed the idea that these canals were the work of a long-gone intelligent extra-terrestrial civilization who built them to carry water from the poles for vegetation purposes. British author H.G. Wells was thoroughly enthused by this idea and penned down the classic science-fiction The War of the Worlds in 1897 where aliens from Mars invaded earth upon the desiccation of their home planet. And thus began the human fascinations with the fourth planet from the Sun in our Solar system. Named after the Roman God of war, Mars is still a mystery in the human quest of the Heavens and truly a mystic one in both realms of earthly science and fiction.

Although in 1950, observations from the more advanced telescope proved that what was thought to be canals was in fact nothing but smaller and distinct features on the surface of Mars and this was eventually confirmed by the first flyby mission to Mars by Mariner 4 in 1965. But strangely enough it is strongly believed, scientifically of course, that amongst all the other candidates in our Solar System, the Red Planet is the one that is most likely to harbor liquid water and possibly extraterrestrial life-form. It must be mentioned here that the current atmospheric condition of Mars is not hospitable enough to sustain liquid water on surface however numerous research suggest

that Mars in fact was once a wet planet with plenty of liquid water flowing down the surface, much like Earth s oceans, a scientific fact backed by the findings of NASA s Opportunity rover in the March of 2004 and Mars Reconnaissance Orbiter Probe in 2008, the later of which further discovered evidences of hot springs which is thought to have contained life and may even now contain well-preserved fossils of life. Radar data from the spacecrafts such as Mars Express (in 2005) and the same Mars Reconnaissance Orbiter (in 2008) have discovered the presence of large quantities of water-ice (water frozen in solid state) in both poles and mid-latitudes of Mars and the volume of water-ice in the south polar ice cap region could alone cover the entire planetary surface to a depth of 11 meters if melted. Based on the study findings of the Lake Vostok of Antarctica, scientists believe that there is a great deal of chance for liquid water to exist below the ice caps of these polar regions of Mars which may contain evidences of past and even present forms of extra-terrestrial life-forms. On July 31st, 2008, the Phoenix Mars Lander, which landed in Mars Arctic Plain, sampled water-ice directly in the Red Planet s shallow Martian soil. There have been plenty of evidences on the existence of water in places of Mars either in or under her highly Iron oxidized soil that includes stream beds, polar caps and eroded craters. Besides there is also strong evidence that liquid water was once existed in this planet was ensured by the discovery of minerals such as hematite and goethite both of which form in the presence of water. By carefully studying the images sent by the Mars Global Surveyor in December 2006, NASA suggested that liquid water even occasionally flows on the surface of Mars as the images showed changes in the craters and sediment deposits which provides the firm evidence that water occasionally course through them. Some of the locations in Mars where scientists believe exists either liquid water or water-ice includes Valles Marineris canyon system, craters Terra Sirenum and Centauri Montes, inner channels Nanedi Valles and Nirgal Vallis, few feet below the surface areas like Arabia Terra, Amazonis quadrangle, Elysium planitia and Elysium quadrangle, the plain of Vastitas Borealis, the fault of Cerberus Fossae

and high latitude region of Ismenius Lacus quadrangle. Back in 2010, a study conducted by the University of Colorado (CU) at Boulder, stated that a vast ocean covered one-third of the surface of Mars some 3.5 billion years ago. After studying a ring of ancient Martian delta deposits and valley networks from the databases of NASA and European Space Agency, the study strongly implied that up to a third of Mars was under about 30 million cubic miles of liquid water. The study further maintained that the ancient red planet probably had an Earth-like global hydrological cycle, including precipitation, runoff, cloud formation, ice and groundwater accumulation which strongly supports the commonly held idea that the planet may have once harbored a rich array of extra-terrestrial life forms. The river deltas on Mars are of high interest to planetary scientists, mostly because deltas on Earth rapidly bury organic carbon and other biomarkers of life and scientists believe same is the situation in the Martian deltas. That research further concluded that the ocean might have covered about 36% of the planet and contained about 30 million cubic miles or 124 million cubic kilometers of water. The amount of water in the ancient ocean would have formed an equivalent of 1800 foot or 550 meter deep layer of water spread over the one third of the 4.6 billion year old planet.

Now some might wonder where all these water could come from? It is believed that once upon a time when Mars was like very much our Earth, Volcanoes of the former would erupt and give off huge amount of gas which mostly would be comprised of Carbon dioxide and water vapor. And it is these water vapors that had enough potentiality to sink the entire Martian surface in the depths of 120 meters of liquid water. And this leads to the obvious question about life on the Red Planet as water is the key to the sustenance of all life-forms. Research of different sources indicates that Mars may not be hostile to life after all. It can be safely stated that so far based on the findings of all the non-manned expeditions to Mars, there is probably no creatures of any size or kind that thrives on the surface regions of the Red Planet. However,

what lies beneath this once Earth-like planet is somewhat a different story. The composition analysis of the ALH84001 meteorite by NASA that was ejected from Mars about 17 million years ago and later found in Antarctica on December of 1984 have revealed to have a certain magnetite (the mineral form of black iron oxide) that is only found in association with certain microorganisms. The latest findings of earthly organisms living in the harshest of conditions have boosted up a new hope amongst scientists that life after all could exist in Mars defying all her rigid environmental challenges. Besides the recent discoveries of Methane and Ammonia on Mars also strongly indicates on the possibility of Martian microbial life-forms. And who knows, maybe detailed studies in the future may even indicate on the odds of extra-terrestrial sea creatures prowling inside the icy liquid ocean that very likely lies underneath the Martian polar caps!

One somewhat latest Martian mission that is worth mentioning is Mars Science Laboratory (MSL) which was a robotic space probe mission to Mars launched by NASA on November 26, 2011, that successfully landed Curiosity, a Mars rover, in Gale Crater on August 6, 2012. The overall objectives of this particular mission include investigating Mars planetary habitability, studying its climate and geology, and collecting data for a future manned mission to Mars that is likely to happen in near future.

Located about one-and-a-half times as far away from the Sun as Earth is, Mars is the only known planet to have an atmosphere or day-time temperatures anything like those of our Earth and such astonishing common feature has placed the Red Planet in the centre of the astronomical wonder. Many even argue that the intelligence that prospered here on Earth is in fact a hereditary succession of a long-gone cerebral Martian civilization. Only time will unearth the extent of science or fiction in this but strangely enough there seem to be some anomalous structures on the surface of Mars which many Ufologists believe to be too bizarre to be formed naturally. One such site where several features that attracted the attention of the Ufologists are the

Cydonia region of Mars where the famous Face on the Mars is located. According to Richard C Hoagland, author of 1987 bestseller The Monuments in Mars: A City on the Edge Forever, the Cydonia region, first located by the Viking 1 orbiter in 1976 is in fact a 500,000 year old ruined city where along with the feature that bore striking resemblances of a Humanoid face there are other evidences of further ancient relics such as a five sided Pyramid, fortress and an artificial cliff. Although later images from Mars Global Surveyor in 1997 revealed that what was thought to be a human face is in fact a trick of light and shadow on an oval shaped Martian plain. But many remain skeptic to this day and strongly advocate that those features on Mars are the remnants of an ancient civilization. Thankfully all these mysteries of the past and the knowledge of the present seem to be guiding mankind towards a more celebratory corridor to Mars. Manned mission to Mars are strongly underway and the words on the space is if Human are to inhabit another planet sometime soon, Mars is the most suitable candidate for such effort. And here is how.

There are radical plans to terraform Mars, which is to transform the Red Planet into a smaller version of Earth. As Mars is a cold planet, to raise a habitable temperature it has been suggested to release Green House Gases into Mars atmosphere along with detonating nuclear warheads on the surface to revive the inactive volcanoes. This will melt the polar caps and commence a much needed hydrological cycle and lastly the chosen surface of the planet could be seeded with plants to produce oxygen and establish a basic survivable ecosystem. And last but not the least; build actual canals on the surface of Mars for good!

The Evening Star

And what about life on Venus, the 2nd planet from the Sun, named after Roman goddess of love and beauty and after the Moon, the brightest natural cosmic object in the night sky? According to scientific minds like that of Carl Sagan, David Grinspoon, Geoffrey A. Landis and Dirk Schulze-Makuch, all of whom once stated in the previous century that that microbes could exist in the stable cloud

layers 50 km (31 mi) above the surface of Venus. It is understood that Venus has a raging temperature reaching a staggering 867 Fahrenheit. How is it then it is possible for life to survive in that hellish temperature? Here is how it works, given that a hellish temperature led to the gradual evaporation of Venus s liquids which eventually triggered any microbial life forms that may have existed on surface in the past not to die out immediately but possibly have had enough time to adapt to the new conditions and ultimately migrate towards the clouds, and that s how many speculate that they survived. And the sulfur present in the atmosphere may even be utilized by microbes to help resist the effects of the intense life-killing heat and UV radiation and carry on living. The clouds of Venus are thought to be mostly uninhabitable, with temperatures at the base reaching 206 Fahrenheit, and negative 46 Fahrenheit at the top. There is, however, a region in the middle of the atmosphere that is actually at a rare Earth-like room-temperature. Unlike the clouds of Earth, these Venusian clouds are much thicker and more stable, with dust particles able to float for months at a time instead of a few days. Some believe this pose perhaps a sufficient time to be biologically sustainable enough for microbes residing on the particles to reproduce and survive. But mind you, so far there isn t any proof out there that life actually exist in Venus and all these are ideas and possibilities on how life might exist on that planet. But at the end of the day and truth of the matter is Venus is perhaps not a strong contender in matters concerning extra-terrestrial life-forms.

The Lone Satellite

Now moving on from Venus, what about our lone satellite Moon? What are the chances of finding some form life over there? While the sun has proven her superiority, it is the moon that the species of earth sincerely like to confide in. That's why she is a major aesthetical inspiration for mankind while the creatures of the wild instinctively howl at her mesmerizing aura, which only strengthens her mysterious nature. However, despite such spiritual adornments, the moon, since

her creation 4.5 billion years ago, has given away very little about her dark side .

What many are not aware of is that there are two sides of the moon and the tidal forces between earth and moon have slowed down the latter's rotation in such a way that the same side of the moon is always facing the earth. This synchronous rotation of the moon -- rotating on her axis in about the same time that it takes her to orbit the earth -- keeps a particular side of the lunar hemisphere permanently turned away from the earth at all times. The side of the moon that earthlings can see is called the near side and the opposite side, which is never visible in its entirety from earth, is known as the far side of the moon and rather popularly, The dark side of the moon ! For thousands of years, humankind's curiosity towards this dark side eventually lead to the exploration where this mystifying far hemisphere of the moon was first photographed by the Soviet probe, Luna 3 in 1959 and directly observed by the human eye during the orbital mission of Apollo 8. The official verdict was the far side is the same as the near side covered with craters and highlands. But rumor has it that there is an Alien Base on the far side of the Moon

Many would doubt this because by now almost everyone has seen the photographs of both sides of the moon taken so nicely by the western satellite probes and evidently their information showed no signs of life or intelligent structures on the surface of the moon. But before all this, since the time Neil Armstrong became the first man to walk on the moon on July 21, in 1969, there was speculation that during their stay on the moon's surface the crew of Apollo11 was never all by themselves. The following conversation between Apollo11 and NASA Mission Control that took place still mystifies people to date:

Apollo11 (Armstrong & Aldrin): What was it? What the hell was it? That's all I want to know. These babies were huge, sir Oh, God, you wouldn't believe it

NASA: What What the hell's going on?

Apollo11: They're here, under the surface.

NASA: What's there? Mission Control calling Apollo11.

Apollo11: Roger, we're here, all three of us. But we've found some visitors They've been here for quite a while judging by the installations I'm telling you there are other spacecrafts out there. They're lined up in ranks on the far side of the crater edge They're on the moon watching us!

According to noted Russian Ufologist and Professor of Mathematics of Moscow University, Dr Vladimir Azhazha, this encounter took place shortly after the landing of Apollo11 but the report of this encounter was never heard by the public as NASA censored it. According to Otto Binder, a former NASA employee, amateur radio enthusiasts on a classified channel, reserved for high security messages, overheard the conversation. In 1979, Maurice Chatelain, NASA's communications expert who also helped design Apollo spacecrafts publicly stated that the encounter between Apollo11 and the UFOs was common knowledge within the NASA . One might wonder what Neil Armstrong and Buzz Aldrin had to say about this. Both of them publicly admitted later in life that they did encounter UFOs on the moon and Armstrong, the first human to walk on the moon, said during a NASA symposium their ships were far superior to ours both in size and technology-Boy, were they big...and menacing ! He went on saying that there is indeed an alien base on the moon. Another former NASA astronaut and fifth man to walk on the moon, Dr. Edgar Mitchell of Apollo 14, in a radio interview in 2008 admitted to the existence of alien life forms describing the beings as little people who look strange to us and in his own words I happen to have been privileged enough to be in on the fact that we've been visited on this planet and the UFO phenomena is real .

In between 1969 to 1972, a total of six manned missions explored the moon including Apollo11 and altogether a total of 12 astronauts walked on the surface of our sole satellite. Every single mission

encountered mysterious anomalies during their stay on the moon. Numerous conversations between these Apollo astronauts and NASA Mission Control confirmed that the ambassadors of earthlings did come across some strange structures and there have been further sightings of UFOs both in the atmosphere and while on the surface of the moon. Some of these structures were referred to as blocked field, benches, beaches, terraces, watermarks, domes, tunnels, constructional ridge and strange tracks. The official claim is that these are just metaphoric terms used to describe unusual natural formations on the moon but then again there were several occasions where astronauts were told to switch to classified radio frequencies and use prearranged special codes like Condorcet Hotel (used by Apollo17) and Barbara (by Apollo16) in order to describe objects that were of great substance and clearly not meant for public knowledge. The question is, if the moon truly is lifeless and ordinary, then why so much secrecy about these findings? Surprisingly, the affirmation on the concealment of the findings on the moon and unusual encounters by the astronauts out there came from none other than the NASA supreme Dr Farouk El-Baz. Few words on Dr El-Baz are in order as he is the Egyptian-American Geologist who, during the Apollo programme years (1967 to 1972) was the supervisor of Lunar Science Planning at Bellcomm Inc. which worked with NASA extensively, secretary of the Landing Site Selection Committee to the moon, principal investigator of visual observations and photography and chairman of the Astronaut training group.

Don Wilson, author of Our Mysterious Spaceship Moon says in his book, Dr El-Baz did admit not every discovery has been announced ! The noted NASA scientist admitted during an interview that there were secret searches for various things on the moon and in his own words, a huge bridge-like structure in Mare Crisium (a region on the moon) has been reported That is all I can say about it . When asked if they were intelligently placed artifacts of extra-terrestrial origin, Dr El-Baz,

although did not say yes, nevertheless went on to say, Almost anything is possible .

Even though numerous findings from the lunar explorations were meant to be kept under lock and key forever, the popular belief amongst the extra-terrestrial enthusiasts and Ufologists is that there is an extra-terrestrial base on the far side of the moon which is secretly acknowledged and referred to as Luna by the intelligence communities of the world. There is also a strong belief that all forms of earthly scientific, exploratory as well as orbiter missions that were aimed at the moon by different nations picked up images of ruined lunar cities, transparent pyramids, castles, domes, mines along with the most speculated about pictures of the alien base. Chances are, these are all far-fetched ideas about the moon and her dark side since it is human nature to speculate on matters that are unfamiliar. But here is where doubt actually steps in.

The moon holds great mystery for many reasons. First and foremost, how it was formed is still in obscurity and scientists only hypothesize about how it could have happened. Secondly, the principle of her revolving around the earth exposing only one particular side at all times is still a wonder for all astronomers. Thirdly, why were the missions to the moon stopped so abruptly? The talk is again on the table about sending manned missions by 2020 and constructing a permanent outpost on the moon from here on. But what caused the one during the era of 1969-1972 to be put on hold? Had it continued, by now there would have been a proud space station set up by human beings on the moon instead of one that is constantly dangling in space? As for the reason behind staying off the moon, Neil Armstrong says, We were warned off ! If this is true, then we must ask ourselves, by whom and why?

But all in all, so far, it can be stated that perhaps there is no sign of life on moon, at least officially so far, chiefly because there is no water on moon. As discussed earlier, water is indeed the central ingredient for the sustenance of life; wherever there is water there will be life, though

the nature of the living organism varies depending on the status of the water. Earth is the only planet in our solar system to have two thirds of her surface covered with liquid ocean water which is believed to be the key factor that triggered the flourishing of lives here on this planet in the first place. But lately, based upon stern scientific observations, it is slowly becoming apparent that oceans and waters are also quite common within our very solar system and in other extra-solar planets as well and the possibilities of extra-terrestrial life-forms in those vicinities are evident than ever before.

The Jupiterian Sixth

Within our solar system, perhaps the most prominent candidate harboring oceans and extra-terrestrial life-forms is Europa, the sixth moon of Jupiter. The Galileo Spacecraft mission of NASA that orbited Jupiter for eight years beginning in 1995 provided vital information on this significant satellite of hers which revealed that the underneath the icy crust of Europa lies salty ocean which is kept warm by tidally generated heat and volcanic activities. Aided by the thick ice model, astronomers argue that the largest of Europa's craters are surrounded by concentric rings and likely to be filled with ice and it is believed that this outer crust of ice is approximately 100km thick only the top 10km are frozen solid which plants the possibility of the existence of a global ocean in a liquid form and at least 62 miles deep beneath these icy crust. Naturally, the hopes of possible life on Europa's ocean skyrocketed with such critical discoveries it has been scientifically suggested that life is very likely to exist in Europa's ocean.

Since Europa s ocean lies quite a few miles beneath the icy crust, it is perceived that the way oxygen influences our existence here on Earth, is perhaps not the case with Europa due to liquid water's separation from atmospheric oxygen by several miles of chilling ice. But it has been proved that without oxygen, life could conceivably exist at hot springs deep in the ocean floor. Life in Europa could exist in its under-ice ocean, perhaps in a similar fashion to that of Earth's deep-ocean hydrothermal vents or the Antarctic Lake Vostok, the largest of more

that 140 sub-glacial lakes found under the surface of Antarctica. Up until 1970's, it was believed that Sun was absolutely essential for the existence of life. But in 1977, during a deep-sea exploration in the Galapagos Rift, scientists discovered flocks of giant tube worms, clams, crustaceans, mussels, and other various creatures gathered around undersea volcanic features known as black smokers and these aquatic creatures were found to have thrived despite having no access to sunlight, depending on an entirely independent food chain! Instead of usual plants, it was found that these unique species depended on a form of bacterium that itself gains its energy from oxidization of reactive chemicals, such as hydrogen o hydrogen sulfide, that bubbled up from the Earth's interior. And all of these provide a great deal of idea regarding how life could survive in Europa's ocean. If life can thrive here on Earth, without the aid of sunlight and in harshest of environments, then why not in Europa?

According to experts, life on Europa could exist clustered around hydrothermal vents on the ocean floor, or below the ocean floor, where endoliths (an organism, e.g. lichen, alga or amoeba that lives inside rock, coral, animal shells or in the pores between mineral grains of a rock) are known to inhabit on Earth. Alternatively, it could exist clinging to the lower surface of the moon's ice layer, much like algae and bacteria in Earth's Polar Regions, or float freely in Europa's ocean. On the other hand, if Europa's oceans were too cold, biological processes similar to those known here on Earth, perhaps won't take place. Volcanic activity provides some of the heat necessary to keep the water on Europa from freezing and provides key dissolved chemicals required by the living organisms. If the water is too salty, only extreme halophiles (organisms that thrive in environments with very high concentrations of salt) could survive in its environment.

Based on all of these, some say such celestial beings could be microbial while others say there might be ones like that of the movie Cloverfield , the gargantuan monster that went on rampaging NYC! Only the findings from the future Europa bound missions could tell

what lies beneath this planet, probably the one NASA is planning to launch in 2020, the Europa Jupiter System Mission armed with objectives ranging from examining Europa's chemical composition to search extensively for extra-terrestrial life in her sub-surface ocean. Two other moons of Jupiter, Ganymede, the largest moon in the Solar system is thought to have a saltwater ocean nearly 200km deep below her surface and Callisto, which the spacecraft Galileo has also revealed to have a subsurface ocean more than 100km deep.

The Sixth of Saturn

Enceladus, the sixth largest moon of Saturn is also another planet within our solar neighborhood that is likely to host liquid water. In 2005, NASA's Cassini spacecraft provided strong evidence on the possibility of liquid salty ocean beneath the frozen surface of this planet. During the flyby mission, the spacecraft detected jets containing water vapor, gas and tiny grains of ice and dust that shoot off hundreds of kilometers into the space from Enceladus's South Pole. This lead to the belief amongst the astronomical community that this enigmatic moon of Saturn has a vast water reservoir hidden deep beneath the moon's icy interior and this global ocean of hers is in contact with the planet's rocky core which is why the eruption of water vapor and ice particles occurs. The possibility of a sub-surface ocean in Enceladus leads to the speculation that this planet, just like Europa, is very likely harboring extra-terrestrial life-form.

The Mighty Titan

Another moon of Saturn, Titan, is also subjected to a great astronomical interest because apart from the possibilities of Sub-surface Ocean it is the only planet in the solar system, besides Earth, to have stable bodies of surface liquids. But her surface liquids are mostly composed of methane, ethane and dissolved nitrogen. Back in 2010, two findings from NASA's Cassini spacecraft have suggested the possibility of alien life-forms on Titan. Observations with the spacecrafts Ion and Neutral Mass Spectrometer and the probe's

Composite Infrared Spectrometer revealed that hydrogen, produced by UV-triggered chemical reactions in the planet's atmosphere, is flowing down Titan's atmosphere and then disappearing at the surface. According to Astro-biologists, this could be a tantalizing hint that hydrogen is getting consumed by life. And at the same time, another study investigating hydrocarbons on Titan's surface found out with the aid of the probe's Visual and Infrared Mapping Spectrometer (VIMS), that there is big shortage of Acetylene, a chemical compound that could be consumed as food by life-forms that relies on liquid methane instead of liquid water to survive.

Now the question comes, why Titan? In response, few words are in order in honor of the solar system's second largest moon. Titan is the only natural satellite known to have a dense atmosphere and the only object other than Earth to have clear evidence of stable bodies of surface liquids (liquid hydrocarbon lakes in the satellite's Polar Regions). The planet has been viewed as similar to the early Earth and thus been suspected of hosting microbial extra-terrestrial life-forms. It's been strongly suggested that methane-based (rather than water-based like here on Earth) extra-terrestrial life-forms could exist on Titan, where organisms called methanogens survive by consuming hydrogen, acetylene and ethane.

All in all, experts believe that, these simply imply that Titan is indeed a dynamic place where organic chemistry is happening right now. The data from the same Cassini mission indicated along with the observational findings on the seasonal variations of the rotation rate of the planet, that this largest moon of Saturn houses a reservoir of liquids, an ammonia-water solution at least 200 km deep, beneath her thick icy surface and a possible host for marine microbial extra-terrestrial life. More interestingly, with Titan's liquid both on surface and subsurface and a energetic nitrogen atmosphere, she has been viewed as analogous to the early earth and it has been also suggested that enough organic materials exists on Titan to commence a chemical

evolution exactly like the one that is thought to have started life here on Earth.

The Galilean Candidate

Jupiter s moon Io is one of the few solar system moons to support an atmosphere and not only it contains complex chemicals promising for life but also volcanism on the moon also makes it warmer than many others which somewhat strengthens the possibilities of life on that planet. But many scientists believe that chances are, Io may not host life after all. And it is because the planet s location is inside Jupiter s magnetic field which means that it is constantly being pelted with lethal radiation. Its violent surface also seems inhospitable, with temperatures often too cold to support life, as well as molten hot spots that are equally deadly.

A New Earth?

Let us sail away from our own solar system for a while. One planet in the extra-solar region certainly requires a great deal of consideration concerning the presence of liquid water. And that is Gliese 581 d which is orbiting the star Gliese 581 and the most crucial aspect regarding this planet is her location in the Habitable Zone of space which is astronomically defined as the region in space where stellar conditions are favorable for life as it is found on Earth. This planet is classified as a Super-Earth due to her mass, which is nearly 8 times that of Earth, and because of this vastness of hers it is also believed that Gliese 581 d is too massive to be made of only stony materials. Further studies have lead to the strong speculations that her atmospheric and temperature conditions are suitable enough for Gliese 581 d to even have a liquid ocean on her surface and thus very much capable of supporting extra-terrestrial life, but more on that later.

Tale of the Dark Sky

At night when we look at the stars and cosmic objects, we see countless of them illumining the sky. It s always a joy to watch objects from our own solar system and beyond. By the way, why sky is dark at

night at the first place? An age old question which seems to have an easy answer and that is it is simply because at night time our side of the Earth faces away from the Sun as a process of her usual 24-hour rotation. But there is a twist though. Given there are 200 billion stars in the Milky Way galaxy alone and over 100 billion galaxies in the whole Universe, shouldn t they be blindingly lighting up the night like the daytime as well? But certainly that isn t the case. And it is mostly because our Universe is approximately 14 billion years old which means that we are living within a observable Universe which is smaller than the total Universe (from visual perspective) and the billions of stars that we talked about earlier remain to this day 14 billion light years away, most of which s light haven t had enough time to reach the Earth. The fact is that the Universe is expanding and all the galaxies and stars are constantly moving away from us, a fact that has been decisively proven by the astronomers.

Previously scientists thought that the dust clouds between the stars were absorbing the surrounding sunlight from distant stars but later they realized that given the billions of years of time-span by that time these dusts themselves would have had absorbed so much energy that they ought to have glowed as hot and bright as the stars. But that wasn t the case. This means that these stars are so far away (even from these cosmic dusts) that their light still remains farther away from human eye to see and the part of the sky to remain dark and that is once the Sun is away illuminating the other side of our world.

This whole concept, in the term of astrophysics, can be understood as the Olbers paradox, also known as the dark night sky paradox developed in 1823 by German astronomer Heinrich Wilhelm Olbers which now basically states that the darkness of the sky reflects the very fact that our Universe started out as Big Bang and it is indeed a finite one. This further explains the fact that since our Universe is about 14 billion years old; there are a huge number of stars beyond our cosmic horizon which we cannot see because their light (even though traveling at the speed of 186,000 miles per second) has not yet arrived to our

visual vicinity. And thus the observable part of the Universe, to us, contains very few stars to fill up the sky like the day time at night.

In this regard another factor needs to be considered and that is even if the universe were infinitely old as well as infinitely large, it would not contain enough fuel to keep the stars shining forever and to fill up all of space with starlight given the fact that most stars, like the Sun, shine for a few billion years before they consume their nuclear fuel and grow dark or end up being a black hole. And so our sky would remain dark at night regardless.

From the Land of the Ancients

Now, getting back from the dark night and the stellar objects of the cosmos...and yes, elements from our own solar neighborhood which s been subject to many legends and sacred philosophies. It seems mankind has always been fascinated with the idea that life was somehow associated with planets and satellites that dwell around our solar system. And not just life, most planets were thought to be God themselves by the ancient societies! Take the case of the mythologies associated with various planets of our solar system throughout the various civilizations of mankind. Here are some popular ones that survived to date.

Mercury, the smallest and closest to the Sun and in Greek mythology was referred to as Hermes, was the messenger-god of Jupiter (the Greek God Zeus, who was the king and ruler of the heavens, Earth and all of Olympian gods) and the god of story telling, eloquence, commerce, and games of chance. He was also prematurely born son of Jupiter and Maia (a fertility goddess). Mercury, who seamed to be very intelligent as a baby; by noon of the day of his birth he left his cradle and invented the lyre, building it from the seashell of a tortoise! And in Greek mythology, he was the god of good luck, wealth, commerce, sleep, and dreams and he was also a patron of merchants, thieves, and deception, the messenger and herald of the gods, and the conductor of the souls of the dead to Hades (the Greek god of the underworld).

Hermes appeared as a young man, wearing a broad-brimmed hat and winged sandals, holding the caduceus (Hermes s staff, which was the symbol of the art of medicine).

After that Venus, the Greek god Aphrodite, was the child of Zeus and Titan, who emerged from the sea foam at birth (in some accounts, Aphrodite simply emerges from the foam), and thus is called the Foam Born . She Was the Goddess of love, charm, beauty, and the impulses that bind men together in social communion. Aphrodite appeared as the wife of Hephaestus, the Mother of Eros, and the lover of Ares (Roman God of War).

Our own planet also has her distinct place in mythology as well. Earth or in Greek mythological terms, Endymion, was in fact a son of Aethus, daughter of Poseidon. He was also a handsome young shepherd who resided on mount Latmus in Caria. The Moon goddess (Selene) loved Endymion very much and she put him into an eternal sleep so she could visit him every evening and eventually Selene bore the sleeping Endymion 50 Daughters!

The mighty Mars, in Greek mythology Ares, was the Roman god of war, one of the chief gods of the pantheon, who was strongly associated with military power and glory. Mars was driven by rage and violence, and preferred to spend his days battling in bloody combat. However, this Greek god Ares (son of Zeus and Hera), in Greek mythology, was a ferocious, brutal, blustering, and cowardly god of War. He was also hated by all of the Gods and Goddess, with the exception of Aphrodite and her sister, Eris (goddess of discord).

Jupiter, the fifth planet from the Sun and the largest planet in the Solar System, according to Greek mythology was Zeus, the God of the heavens, Earth and the god of justice and the ruler over all the other gods. Zeus was the son of the Titans Cronus (the leader and the youngest of the first generation of Titans, divine descendants of Zeus and Rhea (the Titaness daughter of the earth goddess Gaia and the sky god Uranus). At the Age of maturity; he overthrew his father, and

established the rule of the Olympian gods. Zeus was the supreme deity, the most powerful of the gods. He was a sky god, a god of rain and the god of thunder and thunderbolts. Zeus was also a promiscuous god and took many lovers, including his sister and some mortal women.

Saturn, the sixth planet from the Sun and the second largest planet in the Solar System, (in Greek mythology, god Cronus), was the Roman king-god of the Harvest who begot the major Roman gods. This Greek god Cronus, son of Uranus and Gaea, was the god of time and the mightiest Titan of them all. Cronus and his sister Rhea had six Children (the Olympians), but Cronus ate the first five newborns to prevent them from one day overthrowing him. Rhea saved her sixth Child, Zeus, who later did indeed overthrow his father.

Roman god Uranus, also Uranus in Greek mythology, the seventh planet from the Sun with the third-largest planetary radius and fourth-largest planetary mass in the Solar System, was personified as the starry evening sky that came forth spontaneously from Gaea, the ancient Greek mythological personification of the Earth. He was also the husband of Gaea, who together fathered the Titans, the Cyclops, the hundred-handed monster, and other creatures.

Neptune, the Greek god Poseidon, the eighth and farthest planet from the Sun in the Solar System, was the Roman god of water, rain and fertility, also known as the king of the sea or ocean. Neptune and the water nymph, Amphitrite, married and had several children, He was said to be tempestuous, violent and vindictive; he was rarely peaceful. Pluto, the Greek god Hades, as we know, is no longer a planet; in Greek mythology is the lord of the underworld. He was a gloomy, stern and dull god who was also connected to Plutus, a being who personifies wealth. And here comes our own lone satellite. In Roman mythology, Diana, meaning heavenly or divine was the moon goddess of birthing, often associated with wild animals and woodland, and having the power to talk to and control animals. Diana was worshipped in ancient Roman religion and is revered in Roman Neo-paganism, for example Dianic Wicca, a largely feminist form of the

modern day occult practice, is named after her. Diana was known to be the virgin goddess of childbirth and women. Diana was identified with the Greek goddess Artemis, who was also the moon goddess.

Gods or no Gods, at the end of the day, our solar system is unique, chiefly because Earth resides in it which is, so far, the only planet discovered where intelligent life indisputably exists. This is the very fact that made our solar system a stand-out amongst many. Life flourished here and in time, the process of evolution survived to see numerous of miracles, traditionally known as species, to roam on this planet, where some survived the test of time while others were long gone but not forgotten. Even though other planets within this very solar system of ours may not have shown as much promise as ours concerning the success of life, however some of them, as we have seen earlier, indeed are great candidates for future locales where extra-terrestrial life-forms might be found. All in all, this neighborhood of ours is not such a bad place to be. Here Earth reigns supreme with virtually no territorial challenge. But why life came, evolved and survived here is indeed a mysterious question. And to shed some light on that central question, perhaps we need to understand what life truly is at the first place. At least employ some efforts to it at any rate as we all know life is mystery that poses the perfect order and methodical discipline. A system that involves everything, i.e. chemistry, biology, physics and of course much more. Perhaps some understanding of life itself would usher our better comprehension on the possibility of life on other planets, intelligent or not. Amazing are all the histories and mysteries of life, how from the most basic of elements we grew up to be what we are today, not just us, the human beings but every other living elements of our ecosystem. That s quite a journey. Let s travel to the past and see if it leads us to the great, grand future.

Chapter 4 (Life on Earth)

The Lore and the Legends

Previously we have learned, in brief though, on how life came to be here on Earth and eventually flourished. But more words are in order to understand this magnificent phenomenon. How life originated here on Earth? How it prospered like the way it did? But before getting into all the science of things on this, let us understand what the ancients thought about this very question. How the ancients of men pondered and viewed all the aspects that concern the origin of life here on this blue planet? When we study the mythological stories concerning the creation stories we find that some used to think that the world and all the life were created out of an Ex-Nihilo effect where the creation process took place through the thought, word, dream or bodily secretions of a divine being. Another olden idea was that an Earth diver, often times a bird or an amphibian, sent by the creator himself, dived into the seabed through a primordial ocean to bring up sand or mud which developed into a terrestrial world suitable for life. Another creation mythological credence says that the great creator once passed through a series of worlds and metamorphoses until reaching the present world and blessed it with life. While some other ancient ones also say that creations took place by the dismemberment of a primordial being as well as another historic premise says that the whole process commenced at the cracking of a cosmic egg! And the list of such can go on and on.

Let us take a brief tour of histories some of most prominent creation mythological stories.

In ancient Egypt, there were several creation stories, one more complex than the other. But the most common one begins with Nun, the primeval ocean, from which the mighty God Amen rises in grand splendor and takes the name Re, hence becomes Amoen-Re and thus in effect merging two rival deities, Amen and Re. By an act of

masturbation, as described as such in the temple texts, he produces a divine son and daughter. And these two breed a race of gods, while the tears of Amen-Re become mankind. But soon by witnessing man's wayward behaviors, rapidly Amen-Re withdraws himself from the earthly affairs and retires to the heavens, where he reigns as the sun.

Let s move onto one ancient Mesopotamian (modern day Iraq, the birthplace of human civilization) creation story that survived on clay tablets found in Ashurbanipal's library (the ancient Royal Library, discovered around 1851, named after the last great king Neo-Assyrian Empire that had a great collection of thousands of clay tablets and fragments containing texts of all kinds from the 7th century BC). Although the tablets were written back in the 7th century BC, but the origin of the text is believed to go back to at least 1500 BC - a period when Babylon was the dominant city of the region. This creation story, written in the saga known as Enuma elish (named from its first two words, meaning When on high), begins when two watery tumultuous beings, one male and one female, Apsu (sweet water) and Tiamat (salt water) engages in sexual union. And from their coming-together , arrives a variety of sea monsters and gods. Soon a chaos broke out and Tiamat, the female creator, tries to control the situation by exercising her reign. But her descendants got united and chose to rebel against her, selecting one of them, Marduk, the god of Babylon, to lead them in the uprising. Armed with a hurricane and riding a tempest drawn by four fiery steeds, Marduk meets Tiamat and her evil accomplice Kingu in battle and eventually he kills them both. Then he splits the monstrous corpse of Tiamat into two parts and from half of her, he creates the heaven, from the other half the Earth. In heaven Marduk constructs a dwelling place for his colleagues, the gods and realizing that they will need a race of servants, he uses the blood of Kingu to create the first man. This is followed by other essential tasks, such as the creation of rivers, plants and animals, and eventually through this process, Earth experiences her completion in the form and structure as we know it today.

In ancient India, the creation myths, range from familiar themes such as dismembered giants to magical eggs and much more. In one such story Purusha is a primal man who was sacrificed by the gods as the act of creation. And after that the sky comes from his head, the earth from his feet, and the sun from his eye and the moon from his mind. In fact the four castes of Hindu society also derive from his body (Brahmins, Kshatriyas, Vaishyas and Shudras) and the birds and animals come from the fat which drips from him during the sacrifice. Another much later Indian story involves the god Brahma creates, by thought alone, the waters and in them he deposits his seed, which grows into a golden egg. He himself is believed to have been born in the egg. After a year, again by thought alone, he splits the egg in two and the halves become heaven and earth.

In Chinese mythology, P'an Ku, the first living being and the creator of all, is hatched from a cosmic egg and half the shell above him was the sky and the other half below him was the earth. For 18,000 years, he grew taller each day, gradually pushing them apart until they reach their present distinguished locations. After all this effort, P'an Ku falls to pieces, his limbs become the mountains, his blood the rivers, his breath the wind and his voice the thunder. And lastly, his two eyes become the sun and the moon and strangely enough, as for the ultimate finale, the parasites on his body become mankind!

The Japanese creation story begins with a floating amorphous mass, similar to the slithery substance of an egg but moving more like a jelly-fish. From this, there emerges, according Japanese mythology, a reed-like object, which produces eight generations of brother-and-sister gods. The eighth pair of gods is called Izanagi (The Male Who Invites) and Izanami (The Female Who Invites). As the story goes, standing on the Floating Bridge of Heaven, they lean down to stir the brine of the sea with a lance. The liquid begins to curdle and forms an island and the two gods come down on to it, and build a Central Pillar. Behind this they make love, in a delightful passage of divine innocence, to try and create more islands and gods. Their first product is flawed (a child

which cannot stand at the age of three, an island composed of foam) and this was because Izanami spoke first in their sexual encounter. But they ultimately created many gods, including those of the eight islands of Japan. And the gods proliferate (soon there are 8 million) and they have many dramatic adventures, establishing basic patterns of life such as day and night, summer and winter. Eventually the Sun goddess sends her grandson, Ninigi, to rule the central land of Reed Plains which is what we today refer as Japan. Ninigi is granted three treasures as symbols of his rule, a jeweled necklace (symbolizing benevolence), a mirror (purity) and a sword (courage). A necklace, mirror and sword are still the Japanese imperial symbols, kept in an inner sanctuary of Shinto shrines.

The Greek story of creation, it is believed, begins with a gaping emptiness. Within this there emerges Gaea, the earth. She gives birth to a son, Uranus, who is the sky. The world now exists; earth and heaven, and together Gaea and Uranus provide it with a population, their children. First Gaea produces the Titans, heroic figures of both sexes, but her next offspring are less satisfactory; the Cyclops, with only one eye in the middle of their foreheads, are followed by unmistakable monsters with a plethora of heads and arms. Uranus, shocked by his offspring, shuts them all up in the depths of the earth. But Gaea's maternal instincts are offended and she persuades the youngest Titan, Cronus, to attack his father and he surprises Uranus in his sleep and with a sharp sickle cuts off his genitals, which he throws into the sea. Cronus then frees his brothers and sisters from their dungeon, and together they continue to populate the world. But strangely an inability to get on with their offspring characterizes the males of this clan.

Cronus, who has six children with his sister Rhea, eats each of them as soon as it is born. Once again maternal instincts intervene. To save her youngest child, Rhea wraps a stone in swaddling clothes. Cronus swallows the bundle thinking it to be the youngest child and Rhea sends the surviving baby to foster parents. And he is none other than

Zeus and as we learnt earlier, when he is all grown up, he overwhelms his father, defeats all the other Titans in a great war, and then settles upon Mount Olympus to preside over a world which has at last achieved a certain calm. During this time, it appears quite undetectably that mankind has arrived on earth but it is not clear how. But men are certainly there, because a free-thinking Titan named Prometheus smuggles them the valuable gift of fire. These first men are not considered direct ancestors by most Greeks, and there are several Greek mythological versions of how the present race of humans originated. One says that Zeus, exasperated by Prometheus, sends a flood to drown mankind. Two humans escape in an ark. When the flood has subsided, an oracle tells these two to cast behind them the bones of their first ancestor. That ancestor, they reason, is Gaea, the earth. They throw stones over their shoulders, and from each stone a human being is created.

In Norse mythology the creation story goes like this. In the beginning there is nothingness. Gradually this space is filled with water, which first freezes and then partially melts. And from the drops of melting water a giant in human form emerges who is called Ymir. From his armpit a man and a woman appears who are giants like himself, but capable of producing others like them but by more conventional means. Meanwhile a cow one way or another happened to have licked the melting ice and has revealed another giant, from whom the god Odin descends. Odin and possibly his brothers kill the aged Ymir and from his flesh they make the earth and eventually his skull becomes the heavens, his blood the sea, his bones the mountains and from his hair come the trees. Odin then builds a place for himself and the other gods to dwell in, linked to earth by the bridge of the rainbow. And on earth itself Odin and his fellow gods and goddesses breathe life into two tree trunks, turning them into Ask and Embla, the first man and woman on Earth.

In the ancient land of Ethiopia, the creation mythology says that Wak, who was the creator god, lived in the clouds, kept the vault of the

heavens at a distance from the earth and covered it with stars. He was a benefactor and did not punish. When the earth was flat, Wak asked man (whom he himself created) to make his own coffin, and when man did this Wak locked him up in it and pushed it into the ground. For seven years he made fire rain down and the mountains were formed. Then Wak unearthed the coffin and man sprang forth, alive. But man was lonely and got tired of living alone, so Wak took some of the man s blood, and after four days, the blood became a woman whom the man married. They had 30 children, but the man was ashamed of having so many so he hid 15 of them. Wak, out of his wisdom, made those hidden children into animals and demons.

In Zulu mythology, it says that the ancient one, known as Unkulunkulu, was the Zulu creator. He came from the reeds (a common name for several species of tall, grass-like plants generally found in wet places). And from them he brought forth the people and the cattle. In Zulu tradition the process is called Uthlanga, considered to be the source of life and refers to the mythological reed from which humankind was originally created. Unkulunkulu created everything, from mountains, streams, snakes, etc. He taught the Zulu how to hunt, how to make fire, and how to grow food. He is also considered to be the first man himself, the parent of all people and is in everything that he created.

The Pregnant Earth

But we ve come a long way from the creation stories of life as perceived by the ancient civilizations. Science has taken over towards our understanding of how life began here on Earth and how life could evolve elsewhere in the Universe. The emergence of life, especially human life, in the universe is much more than a random event as it required the presence of right things at the right places and at the right time. We know, the presence of four chemical elements carbon, oxygen, nitrogen and phosphorous are crucial to life's origin. But only hydrogen and helium were formed immediately after the Big Bang. Before more complex elements essential for the sustenance of life

could form, stars came into existence. The stars forged those elements in their fiery interiors and then they ran their natural course of lifecycles before releasing them into space. And in order to allow these elements to evolve, the balance between the four forces of Universe had to be right. And it took 13 billion years or so for the universe to allow these elements to come together in an environment where life could finally develop and sustain.

And as far as Earth is concerned, this is what we understand about our own planet. Over the years, in the span of millions, the primordial atmosphere was produced by the out-gassing and volcanic activities and later ice and liquid water that were delivered by the asteroids and larger proto-planets, comets and trans-Neptunian objects condensed the existing water vapor resulting in the creations of the oceans, the source of all life forms on Earth. On time-scales lasting hundreds of millions of years, the surface continually reshaped, breaking and forming continents and the absorption of harmful ultraviolet radiation by the ozone layer, eventually allowed the flourishing of life on earth. Amazingly although life has existed here for about 200 million years but compare to Earths era, the 10 million species of life that have had housed on Earth (currently 1.5 million of animal species) have only been present for 5 per cent to 10 per cent of this planet's entire lifetime!

The only planet not to be named after a mythical God, Earth, with a diameter of almost 8,000 miles, is the only planet in the Solar system which is known to be geologically active with her formation of lands through earthquakes and volcanic activities while replenishing carbon dioxide into the atmosphere and obliterating impact craters from meteors. Mostly consisting of oxygen, silicon, aluminum, iron, calcium, sodium, potassium, magnesium, nickel and carbon, Earth travels at an orbital speed of 66,700 miles per hour in her course around the Sun. But this around 200 million square miles pumpkin shaped planet is gradually getting slower when it comes to rotating around her axis and astronomers explain that this sidereal day which

is universally known as 24-hour day, was 20-hour day millions of years ago and many believe that the pace of Earth will get more slower with 27 hours long days million of years later. Not only is that but Earth getting fat too, especially at the equator to the extent of millimeters, becoming slightly more spherical as the mountain glaziers melt and already this planets weights about 6,585,600,000,000,000,000,000 tons!

And what about the layers of gases around Earth's atmosphere that reaches out to about 10,000 km above her surface? The thickest of such is within 50km and in fact 75 per cent of earth's atmosphere is contained within the first 11km above the planet's surface due to the pull of earth's gravity while the rest of the atmospheric density is extremely thin and this leads to the fascinating fact of the fall of space dust on earth. According to United States Geological Survey (USGS), roughly 1,000 tons of space dusts make their way through earth's atmosphere and fall on her surface every year and some scientists even claim celestial microbes rain down from space, which is principally responsible for flu epidemics on earth! While still in outer space, it is fascinating that along with moon there are also two additional asteroids that are locked into a co-orbital course with planet earth. The first one is 3753 Cruithne which is 5 km across and also referred as earth's second moon has a synchronized orbit of her own following distinct path around the Sun. And the second one is 2002 AA29, which is only 60 meters across and her horseshoe orbit around earth brings her close to this planet every 95 years.

Now to the centre of earth, the molten iron core which at times erupts onto the surface through volcanic eruptions is in fact 7,500° C hotter than the surface of Sun and creates a magnetic field known as magnetosphere which in effect protects this planet from Sun's detrimental solar wind by channeling the later around the earth. Talk about fighting fire with fire! And the oceans, that flamboyantly cover 70 per cent of the planet's surface, hold great mysteries of earth which is also responsible for her nickname, The Blue Planet and the source

of 80per cent of all life on earth. The fact that 90per cent of all volcanic activities occur alone in the oceans is inspirational for scientists on the understanding of the idea of survival of life in the harshest of conditions that led to the assumption of possibility of life on other planets!

The earth sure has come a long way and been home to millions of species and other life forms. But what is the future of this planet? To be precise, it is scientifically expected that the world will continue supporting life for another 1.5 billion years. But as the survival of this planet is crucially dependent on Sun, within 3.5 billion years the rising luminosity of the later will eventually eliminate earth's biosphere, destroy the vegetations which will lead to the loss of oxygen and gradual drying up of the oceans and all the water bodies, hence the extinction of all life. Scientists explain by that time earth will look like today's enigmatic Saturnian moon, Titan, the ultimate desert planet with her giant dunes and ocean less surface.

But before all that extinctions that are likely to take place after billions of years, let us understand first how exactly life began here on Earth and what exactly was the process of evolution of life on this unique planet. Basically there are two biochemical theories on the origin of life here on Earth. The first one focuses on genetics with RNA or DNA replication as an essential condition for the success of Darwinian evolution. The other one focuses on metabolism. At the beginning of 20th century, Dr. Alexander Oparin established the Metabolism First hypothesis to explain the origin of life, emphasizing the primary role of cells as small drops of coacervates (evolutionary precursors of the first prokaryote cells which are thought to be the first living thing ever to exist on Earth). Later it was scientifically demonstrated that sets of chemical components store information about their composition which can be duplicated and transmitted to their descendants, a process referred to as compound genomes .

Let us go into details.

It is believed that the earliest life on Earth existed at least 3.5 billion years ago, during the Archean Era (that was about 3800-2500 millions of years ago) that was followed by the molten Hadean period (approximately 4600-3800 millions of years ago). The earliest specific evidence for life on Earth happens to be a biogenic (produced or brought about by once living organisms) graphite which is thought to have been found in a 3.7 billion-year-old meta-sedimentary rocks that was discovered in Western Greenland microbial mat fossils. And the mat fossils themselves were discovered in 3.48 billion-year-old sandstone in Western Australia. When the Earth calmed down after her turbulent birth, lightning and ultraviolet lights from the Sun were breaking apart the simple hydrogen-rich molecules of the primitive atmosphere which, in affect, made the fragments of broken down particles spontaneously recombining into more and more complex molecules. The creations of this early chemistry were dissolved in the oceans, forming a kind of organic soup which increasingly got complex. And then one day, strangely enough, a molecule was born that was able to make crude copies of it self, using as building blocks other molecules in the soup!

Cosmos Calling

Carl Sagan, in his book Cosmos (published in 1980) described the thriving of life here on Earth in a very specific and comprehensibly sensible way. Let us read quite a few excerpts concerning what took place afterwards. We were at a stage when the birth of the molecule that was able to duplicate itself with the aid of other molecules which ultimately ushered the earliest ancestor of deoxyribonucleic acid, DNA, the master molecule of life on Earth.

Here is what Sagan s Cosmos described of what took place in sequence after that very miracle in the chapter One voice in the cosmic fugue :

It is (DNA-the master molecule of life on Earth) shaped like a ladder twisted into a helix, the rungs available in four different molecular

parts, which constitute the four letters of the genetic code. These rungs, called nucleotides, spell out the hereditary instructions for making a given organism. Every life form on Earth has a different set of instructions, written out in essentially the same language. The reason organisms are different is the differences in their nucleic acid instructions.

Four billion years ago, the Earth was a molecular Garden of Eden. There were as yet no predators. Some molecules reproduced themselves inefficiently, competed for building blocks and left crude copies of themselves. With reproduction, mutation and the selective elimination of the least efficient varieties, evolution was well under way, even at the molecular level. As time went on, they got better at reproducing. Molecules with specialized functions eventually joined together, making a kind of molecular collective - the first cell. By three billion years ago, a number of one-celled plants had joined together, perhaps because a mutation prevented a single cell from separating after splitting in two. The first multicellular organisms had evolved.

Sex seems to have been invented around two billion years ago. Before then, new varieties of organisms could arise only from the accumulation of random mutations - the selection of changes, letter by letter, in the genetic instructions. Evolution must have been agonizingly slow. With the invention of sex, two organisms could exchange whole paragraphs, pages and books of their DNA code, producing new varieties ready for the sieve of selection. Organisms are selected to engage in sex - the ones that find it uninteresting quickly become extinct.

By one billion years ago, plants, working cooperatively, had made a stunning change in the environment of the Earth. Green plants generate molecular oxygen. Since the oceans were by now filled with simple green plants, oxygen was becoming a major constituent of the Earth s atmosphere, altering it irreversibly from its original hydrogen-rich character and ending the epoch of Earth history when the stuff of life was made by non-biological processes. But oxygen tends to make

organic molecules fall to pieces. Despite our fondness for it, it is fundamentally a poison for unprotected organic matter. The transition to an oxidizing atmosphere posed a supreme crisis in the history of life, and a great many organisms, unable to cope with oxygen, perished. A few primitive forms, such as the botulism and tetanus bacilli, manage to survive even today only in oxygen-free environments. The nitrogen in the Earth s atmosphere is much more chemically inert and therefore much more benign than oxygen. But it, too, is biologically sustained. Thus, 99 percent of the Earth s atmosphere is of biological origin. The sky is made by life.

For most of the four billion years since the origin of life, the dominant organisms were microscopic blue-green algae, which covered and filled the oceans. Then some 600 million years ago, the monopolizing grip of the algae was broken and an enormous proliferation of new life forms emerged, an event called the Cambrian explosion. Life had arisen almost immediately after the origin of the Earth, which suggests that life may be an inevitable chemical process on an Earth-like planet. But life did not evolve much beyond blue-green algae for three billion years, which suggests that large life forms with specialized organs are hard to evolve, harder even than the origin of life. Perhaps there are many other planets that today have abundant microbes but no big beasts and vegetables.

Soon after the Cambrian explosion, the oceans teemed with many different forms of life. By 500 million years ago there were vast herds of trilobites, beautifully constructed animals, a little like large insects; some hunted in packs on the ocean floor. They stored crystals in their eyes to detect polarized light. But there are no trilobites alive today; there have been none for 200 million years. The Earth used to be inhabited by plants and animals of which there is today no living trace. And of course every species now on the planet once did not exist. There is no hint in the old rocks of animals like us. Species appear, abide more or less briefly and then flicker out.

Before the Cambrian explosion species seem to have succeeded one another rather slowly. In part this may be because the richness of our information declines rapidly the farther into the past we peer; in the early history of our planet, few organisms had hard parts and soft beings leave few fossil remains. But in part the sluggish rate of appearance of dramatically new forms before the Cambrian explosion is real; the painstaking evolution of cell structure and biochemistry is not immediately reflected in the external forms revealed by the fossil record.

After the Cambrian explosion, exquisite new adaptations followed one another with comparatively breathtaking speed. In rapid succession, the first fish and the first vertebrates appeared; plants, previously restricted to the oceans, began the colonization of the land; the first insect evolved, and its descendants became the pioneers in the colonization of the land by animals; winged insects arose together with the amphibians, creatures something like the lungfish, able to survive both on land and in the water; the first trees and the first reptiles appeared; the dinosaurs evolved; the mammals emerged, and then the first birds; the first flowers appeared; the dinosaurs became extinct; the earliest cetaceans, ancestors to the dolphins and whales, arose and in the same period the primates - the ancestors of the monkeys, the apes and the humans. Less than ten million years ago, the first creatures who closely resembled human beings evolved, accompanied by a spectacular increase in brain size. And then, only a few million years ago, the first true humans emerged .

The Stages of Evolution: the tales of Life on Earth

That s pretty much the brief depictions of Cosmos on how life evolved here until the fruition of human beings. But if we break it down more on the origin of life here on Earth and the different stages where and how it evolved and what exactly took place in, around and in-between, the following is what we get. This next depiction of the 20 stages of evolution of life on Earth was chiefly taken from a meticulous writing titled Evolution of Life , penned down by the

authors of New Zeeland s prestigious University of Waikato s (UoW) School of Science and Engineering. And that writing is available at this following web-link: http://sci.waikato.ac.nz/evolution/EvolutionOfLife.shtml. And the story goes like this:

1) The Hadean Period:

The first Earthly geologic era, the Hadean period began after the birth of Earth, about 4600 millions of years ago (4.6 billion years) which lasted from 4600 million years (M.Y.) to 3800 M.Y. ago. During this period the heavier molten iron sank to the center of the newly forming Earth, which later became Earth s core. And the lighter material rose to the surface, the lightest of all ultimately becoming the crust on the surface. There was also an out-gassing of volatile molecules such as water, methane, ammonia, hydrogen, nitrogen, and carbon dioxide, which strongly influenced the formation of the early atmosphere of this planet. And the preliminary steam atmosphere of hers was made of water from comets and hydrated minerals from volcanic eruptions.

Right after the Hadean era, the only inhabitants of the Earth were simple microscopic organisms, many of them comparable in size and complexity to modern-day bacteria. The conditions under which these organisms lived varied greatly from those prevailing today, but the mechanisms of evolution were basically the same. Genetic variations made some organisms better fitted than others when it came to survival and reproduction in a given environment. The emergence of new forms of life through this principle of natural selection exerted great changes on the physical environment which greatly influenced the entire process of evolution.

2) & 3) The Archaean Period & the Proterozoic Era:

After the Hadean era, the period between 3800 and 2500 million years ago is called the Archaean Eon, meaning ancient. Life that arose on Earth during the early Archaean era, as pointed out by the appearance of fossil bacteria in rocks, are thought to be about 3500 million years

old. At first, it may seem surprising that bacteria can leave fossils at all however, one particular group of bacteria, known as the Cyano-bacteria or blue-green algae have left a fossil record that extends far back into the Precambrian period. And the oldest Cyano-bacteria like fossils known are nearly 3500 million years old and are among the oldest fossils currently known.

The final epoch of the Precambrian era was the Proterozoic (meaning early life) Era and this pre-historic eon spans the time period between 2500 million and 544 million years. Fossils of both primitive single celled and more advanced multi-cellular organisms begin to appear in abundance in rocks from this era and the oldest multi-cellular algae fossil of this time dates back to 1200 million years. At this time biological diversity increased greatly to influence the birth and the evolution of the eukaryote cells. Different to the prokaryotic cells, the eukaryotic cells are larger and have a complex internal organization which includes a nucleus that houses the chromosomes and specialized structures known as organelles, a biological phenomenon which influenced the evolution of organisms further down the road.

4) The Vendian Period:

The time period during which the first animals in the fossil record appeared were between 620 and 550 million years ago and is called the Vendian era which is also known as the Ediacaran period. This era is distinguished by a distinctive collection of fossils from complex soft-bodied animals. But the Ediacarian/Vendian era faunas have puzzled many paleontologists, because although some of these animals may have belonged to groups that survive today, others don't seem at all linked to animals we know today. There are two puzzling aspects of the Vendian or Ediacaran organisms. First one is that there does not seem to be any evidence for any skeletal hard parts, in any of those fossils which indicates the very fact that the organisms were soft bodied. Second factor is the issue of which group of animals these group of fossils actually belong to. Although many have been compared to the modern day jelly fish or worms but at the same time

they have also been compared to be somewhat similar to organisms with somewhat tough outer walls and fluid filled internal cavities, something like sponges which are regarded as quite primitive animals.

5) The Cambrian Period:

The earliest period of the Palaeozoic era is called the Cambrian Period. It is named after Cambria, the Roman name for Wales, where rocks of this age were first identified by the nineteenth century geologist Adam Sedgwick. The Cambrian fossils include animals with body plans similar to those of a number of present day living animals and they represent the lineages of almost all animals existing today. This stunning and unique evolutionary blossoming is termed as the Cambrian explosion but it was not as rapid as it sounds as the changes seem to have happened over the span of about 30 million years. The emergence of many kinds of creatures during the transition from the Precambrian to the Cambrian radically changed the nature of the relations among animals, including the development of more complex predator-prey relationships. Animals that used to feed on living matter, rather than scavenging on dead organic matter, grew to be much more common and even predators, such as Anomalocaris, evolved to eat those who could not escape them.

The definite cause of the Cambrian explosion is a matter of debate among the scientists. Some point to the increase in oxygen that triggered a higher metabolic rate which allowed the evolution of larger organisms and ultimately development of more complex body structures. Others propose that an extinction of life at the end of the Vendian period that opened up ecological possibilities that the new species exploited. A change in ocean chemistry may have also contributed, allowing for the first time the development of hard body parts such as teeth for life forms. Genetic factors were also crucial during this period. It is believed that the era prior to the Cambrian explosion saw the gradual evolution of a genetic tool kit of genes that govern developmental processes of organisms. And thus once assembled, during the Cambrian era, this genetic tool kit enabled an

unprecedented period of evolutionary experimentation, competition and evolution that eventually saw the success of life.

6) The Ordovician Period:

The time period between 505-440 million years ago is called the Ordovician eon and although during this age, the first plants happened to have appeared however it was not until the late Silurian era before they resembled modern plants. This period is best known for the presence of its diverse marine invertebrates (animal species that do not possess or develop a vertebral column), including Graptolitestrilobites brachiopods, and the Conodonts (early vertebrates). Back then a typical marine community consisted of these animals, plus red and green algae, primitive fish, cephalopods, corals, crinoids, and gastropods. And in time, a burst of evolution went on to triple the diversity of marine animal life in the span of 50 million years.

One significant factor of this era remains the Fish population. Fish are members of the chordate phylum because they display certain defining characteristics, like having a backbone that replaces the notochord of the simpler chordates, a dorsal nerve, gills and a tail. Agnathans, or jawless fish were the earliest fish and considered to be the first true vertebrates and they appeared around 480 million years ago. One of the Agnathan lineages was the Ostracoderms, the earliest jawless fish, dating back around 510 million years who were mostly bottom-feeders and were almost entirely covered in armor plates. As jaws evolve in the bony fish and early sharks around 450 million years, jawless fish had trouble competing which is why perhaps Hagfish and lampreys are the only jawless fish alive today. With these new groups of fauna, the ocean ecology restructured itself and the new species adapted to use the existing resources more efficiently. After this reorganization of evolving lifestyles, species lasted longer and extinction occurred less frequently than among the Cambrian ancestors.

Few words are in order regarding one standout fish species of this era. And that s none other than sharks. Sharks are one of the oldest known

creatures of the modern world, dating back to 440 millions years or so and some of the present kinds have been known to be around for about 100 millions of years, the very time when the dinosaurs used to roam our planet. Remarkable aquatic creatures in their own rights, with more than 350 species of its kind, (75 in the list of endangered species), sharks are a wondrous biological entity of our earthly ecosystem with stellar characteristics. Sharks, known to live up to 30-100 years and can be found in all seas all over the globe, never get cancer, pose amazing healing power to cure its own wounds and show remarkable resistance to many life-threatening diseases and this is why this fierce predator is subject to cancer research, in search of a cure for this deadly disease. Sharks do not have any bones; instead its skeleton is made up of cartilage, the stuff that shapes our ear! The skin of this creature is another interesting factor as instead of scales, like other fishes, sharks has thousands of miniature teeth called denticles embedded in its skin. And this skin-tooth layer acts as armor suit and provides protection for the shark and this nature of skin is so durable that in the olden times the skin was used as sandpaper and nowadays often used to make expensive shoes and drums. Sharks are also known for their keen sense of smell, not only that they can smell a drop of water in a million drops of water, 2.5 miles away (two third of its brain is dedicated to smell), but also they have remarkable sensitivity to vibration of water which means that they can feel the movements made by other animals that are hundreds of feet away and it is because they have electroreceptor organs called Ampullae of Lorenzini, that detect the electromagnetic field generated by all living things. Sharks are also known for their distinct teeth. It has been found that each kind of shark is armed with teeth that fit its dietary lifestyle, some have knifelike, fork-like with either sharp or blunt or rounder shape sizing from large to small but it is understood that sharks have 5 to 15 rows of teeth in each jaw and their teeth are known to fall easily as easily they are replaced. It is believed that a shark can have up to 30,000 teeth in its lifetime.

The biggest carnivore shark is the Great White which grows up to 21 feet (even more) in length and weighing about 5,000 pounds and the smallest shark known to man is the Dwarf Lanternfish (6 to 7 inches), Spined Pygmy Shark (7 inches) and Pygmy Ribbontail Catshark (6 to 7 inches). Bull Sharks are often captured for display in aquariums, as this is one of the few species of shark that survives well in captivity and Sand Tiger Sharks are most active at night whereas the hammerhead shark has the best sense of smelling. Research has found that the Portuguese Shark can dive more than 1.5 miles, or 2.7 kilometers, below the surface of the ocean and females are usually larger than males and have thicker skin to withstand the bites of males wanting to mate with them. The dogfish sharks are named for their tendency to attack their prey just like a pack of wild dogs does, in group formation.

Another amazing fact about sharks is that they have to move all the time in order to stay alive, and this is because sharks must force seawater through their open mouths and over their gills (the paired respiratory organs of fishes) in order to breathe when resting, shark do that on the sea bottom where the current is strong enough to flush water over their gills. Research has found that oil in the liver is what keeps the shark from sinking as its density is lower than that of the surrounding water. Sharks do not sleep the same way us humans do, and then again we are not fishes. But it is believed that they might seem as if they are sleeping but they are really just resting! Some sharks are known swim up to 20-40 miles per hour and sharks can see almost as well behind them as they can in front.

Even though sharks are fish but most sharks give birth to their babies and few lay eggs and baby sharks are on their own (baby sharks are born with sharp teeth and the ability hunt right from the start) from the very moment of their birth except few, like the dogfish shark who are known to keep their babies up to for 18 to 24 months and like many other species, sharks learn through experience. In fact baby sharks begin their hunting and killing before they are even born by consuming their weaker siblings inside their mother s oviduct. Sharks are one of

nature s most prolific hunters and the top one of the underwater food chain. Even though sharks are sort of fussy eaters but their hunger can be satisfied with one hearty meal and sometimes, after such meal, sharks do not eat for a while which can last for few moths straight!

There is misconception that sharks are very, very dangerous species, thanks to movies like Jaws but in reality sharks attack about 100 people every year and out of which 10 result in human fatality. And usually shark attack on a human usually occurs in less than 6 feet 6 inches of calm water, and within a relatively short distance from shore. On the other hand, every single year human beings kill tens of millions of sharks every year for their skin, fins, meat and liver oil. No wonder shark has been categorized as an endangered species. It s about time mankind put an end to such indiscriminate slaughter of sharks.

7) The Silurian Period:

The Silurian period, named after a Celtic tribe called the Silures, was one of the most significant times of all eras because it was the time when some plants and animals left the water and colonized the land for the first time. Why they left the water is a matter of debate but it was probably the result of the fierce competition in the marine ecosystems, a means to escape from the aquatic predators and of course the availability of new land-based environments. Once animals and plants became established on land they significantly contributed to the changes in the very nature of the physical and chemical processes on Earth. Somewhere around this time, the early vascular land plants, so named for their internal system of tubing that circulates water and nutrients, evolved around 425 million years ago. Most grew only a few centimeters tall but were still tall enough to send shoots skyward to capture sunlight and release reproductive spores to the winds. And with deeper root systems than earlier plants and a rigid vertical stem, they were now equipped to colonize more of the Earth's surface.

Arthropods (an invertebrate animal having an external skeleton, a segmented body, and jointed appendages, example-insects, spiders,

crustaceans, and others) were the first animals to adapt to the land, making their appearance in that era around about 420 million years ago. Fossil footprints of arthropods from Western Australia that got imprinted ages ago in the sandy flats surrounding temporary lakes indicate that these animals may have accompanied the landward march of plants. But in most ways they were pre-adapted to life on land. And by the time they moved ashore, they had already evolved lighter bodies but strong legs to counteract the force of gravity. Their hard outer shells, called cuticles, provided protection and retained moisture. Spiders, centipedes and mites were among the earliest land variants and some of them indeed were the giants of their joint-legged kind. And the longest kind of its species was Slimonia, a relation of the modern-day scorpions, which s size, was superbly to that of modern man!

8) The Devonian Period:

The Devonian period was named after Devonshire, England, where rocks of this age were first studied. During this period, early arthropods and vertebrates continued to colonize the land and the animals had to solve the same problems that plants faced when they moved to the land, such as maximizing oxygen uptake and adapting to a non-aquatic environment. But the evolutionary advances that solved these problems not only allowed animals to march into land, but also to spread over the continents. The first tetrapods, or land-living vertebrates, appeared during this era, as did the first terrestrial arthropods, including wingless insects and the earliest arachnids (a class of joint-legged invertebrate animals) which had already ventured onto land during the Silurian era.

While arthropods vertebrates strived to occupy land, the sea was teeming with life as well. By the Late Devonian plants with true roots and leaves, many of them rather tall, had evolved and by the end of the Devonian era, the first seed plants had appeared and this rapid appearance of so many plant groups and growth forms has been called the Devonian Explosion .

9) The Carboniferous Period:

The Carboniferous Period extended from 360 to 286 million years ago and one of the greatest evolutionary innovations of the Carboniferous era was the amniotic egg which crucially allowed early reptiles to move away from waterside habitats and colonize dry regions. The amniotic egg allowed the ancestors of birds, mammals, and reptiles to reproduce on land by preventing the embryo inside from drying out, so eggs could be laid away from the water. And that natural phenomenon perhaps resolves the chicken and egg theory: that whether egg came first or chicken. Well, evidently chicken because when the ancestors of chicken migrated from sea to land they developed the process of laying eggs in amniotic form in order to protect their offspring and adapt to the then environmental scenarios of the land and hence from chicken comes egg and eventually from egg comes chicken! Also, during this particular period evolved the very early Cotylosaurs (primitive reptiles), the Hylonomus and Paleothyris who were lizard-sized animals with amphibian-like skulls, shoulder, pelvis, & limbs, and intermediate teeth and vertebrae.

10) The Permian Period:

The Permian period was the final period of the Paleozoic era and is named after the province of Perm, Russia, where rocks of this age were first studied. One of the most striking transitions in the evolution of life occurred when mammals evolved from one lineage of reptiles and this transition began when the reptile group that included Dimetrodon gave rise to the beast-faced therapsids. The development of a key mammalian trait, the presence of only a single bone in the lower jaw, can actually be traced in the fossil history of this lineage. However, at the end of the Permian era, it was the dinosaurs, not the mammal-like reptiles, which took advantage of the newly available niches to diversify into the dominant land vertebrates. And among plants, Lepidodendron and Sigillaria became rare, but ferns and conifers persevered.

The distinction between two previous eras, the Paleozoic and the Mesozoic, is made at the end of the Permian one, in recognition to the largest mass extinction that was recorded in the history of life on Earth. It affected many groups of organisms in many different environments, but its greatest impact was on the marine communities as it caused the extinction of 90-95% of marine species of that time. And on land, the extinction cleared the way for life forms there to flourish and dominate and that led to the era that is now known as the Age of Dinosaurs . Although the cause of the Permian mass extinction remains a debate, as for possible explanations include Glaciations (Ice Age), the formation of Pangaea (a super-continent that existed during the late Paleozoic and early Mesozoic eras, forming approximately 300 million years ago) and volcanism are some of the theories as well as extraterrestrial causes like an impact with an asteroid that caused the mass extinction.

11) The Triassic Period:

The Triassic period was the earliest period of the three Mesozoic eras (Triassic, Jurassic and Cretaceous). Dinosaurs, which are perhaps the most popular cratures of the Mesozoic era, evolved in the Triassic one, but were not very diverse until the Jurassic period. The organisms of the Triassic can be considered to belong to one of three groups: those that survived the mass extinction in the late Permian, new groups which flourished briefly, and new groups which went on to dominate the Mesozoic world. The survivors included plants like the Lycophytes, Glossopterids, and mammal-like reptiles like Dicynodonts and of course, the dinosaurs.

During the Triassic period major changes were taking place in the posture of several groups of reptiles. They were shifting from the standard sprawling mode to an erect posture. The dinosaurs of this era, or terrible lizards , fall into two initial groups on the basis of their hip structure: the Saurischians and the Ornithischian. Saurischians are furthermore subdivided into Theropods (such as Coelophysis and

Tyrannosaurus rex) and Sauropods (e.g. Apatosaurus). And most scientists agree that birds evolved from Theropod dinosaurs.

12) The Jurassic Period:

The Jurassic period was the middle period of the Mesozoic era, spanning the time between 213 and 145 million years ago. It is named after the Jura Mountains between France and Switzerland, where rocks of this age were first studied. Although Hollywood almost single handedly made the Jurassic era famous with its blockbuster series Jurassic Park movies but the key factor lies of this era s of offer of its wealth of fossils. Studies of oxygen isotopes, the extent of land flora, and marine fossils indicate that climates during Jurassic times were mild, perhaps 8°C warmer than those of today. No glaciers existed during this period. As it is understood, the plant life of the Jurassic was dominated by the cycads, but conifers, ginkgoes, horsetails, and ferns were also abundant. Creeping about in this foliage was a number of early mammals, no bigger than rats. Of the marine invertebrates, the most important were the ammonites and the dominant animals on land, in the sea, and in the air were the reptiles. Dinosaurs, more numerous and more extraordinary than those of the Triassic period, were the chief land animals; crocodiles, ichthyosaurs, and plesiosaurs ruled the sea, while the air was inhabited by the pterosaurs, the flying relatives of the dinosaurs.

Now, more on dinosaurs, the mighty prehistoric creatures which roamed our great blue planet millions of years ago were uniquely fascinating, exemplars of which are still evident in their fossils that are being discovered now and then. And the strenuous study of these priceless fossils sure did open up few windows to the way of life of these amazing creatures of the past. For example, dinosaurs, (meaning terrible lizard) a term coined by the British anatomist Sir Richard Owen back in 1842, were not the first reptiles to rule the Earth. In fact, before first dinosaurs evolved during the middle to late Triassic period about 230 million years ago, the dominant land reptiles on Earth were Archosaurs (ruling lizards) , therapsids (mammal-like reptiles) and the

fearsome Jurassic crocodiles. The kingdoms of the dinosaurs are divided, not accordingly into herbivores (plant eaters) and carnivores (meat eaters) but rather paleontologists categorize these creatures as saurischian (lizard-hipped) and ornithischian (bird-hipped) dinosaurs. And strangely enough modern-day birds evolved from the lizard-hipped kind dinosaurs rather than the bird-hipped kind during the late Jurassic (150 million years ago) and cretaceous periods (80-65,000 million years B.C). One of the first dinosaurs was Plateosaurus, a 6 meters long and 3 meters tall herbivores weighing abut a ton and one of the first carnivores would be Coelophysis.

Despite T-Rex s massive public image as a fierce carnivorous predator, surprisingly, most of the dinosaurs (65 per cent) were vegetarians and there were both cold-blooded and ectothermic and warm-blooded that is endothermic dinosaurs back then. And not all the dinosaurs were dummies given many required better-than-average eye sight, smelling power, skillful agility and systematic coordination to hunt down preys. One of the smartest of all the dinosaurs was Troodon, a hunting one, about 2 meters long with stereoscopic vision and grasping hands. Even though it is often thought that mammals came after the extinction of the dinosaurs but in fact, the earliest mammals (scientists believe that they were mostly early fur-ball like creatures about the size of mice, but exception includes 50 pound weighing Repenomamus) lived alongside the mighty beasts but mostly housing high up in the trees for the large part of the Mesozoic era. It can be stated that so far 250 to 1300 different species of dinosaurs have been discovered and many hope that the number will keep on rising.

It is believed that the heaviest dinosaurs Brachiosaurus, weighing 80 tons, 16m tall and 26m long which is almost equivalent to 17 African elephants and the smallest one was the little bird-hipped, plant-eater lesothosaurs, sizing like that of our modern day chickens. The tallest dinosaurs were undoubtedly the Brachiosaurid group of sauropods ranging 13 meters to 18.5 meters and the fastest running dinosaurs were ostrich mimicking ornithmimids like Dromiceiomimus which

could run up to 60-80 km per hour. These beasts were indeed old but which one is the oldest of them all? Well, the oldest dinosaur would be one that is yet to be named, found in Madagascar, which is about 230 million years old and before than Eoraptor (meaning Dawn thief) that was about 228 million years old. And perhaps the most caring dinosaur is the 7 meters long, 3 meters tall and weighing 3tons carnivore Maisaura, the female of which kind is known to care for their babies the most.

How the era of dinosaurs came to an end, there are quite a few theories but the most acceptable one is that a massive asteroid hit Earth which s impact was so devastative that the atmosphere of Earth was covered with dust and eventually with the absence of sunlight, plant s couldn t grow. And there was no plants, the plant eating dinosaurs died out and since the plant eating dinosaurs were all dead, the mean eating ones eventually starved to death. Thus, no dinosaurs means no reproductions and hence the absolute extinctions of the mighty creatures from the face of Earth. Although rumor has it that quite a few still exists in the mysterious locations of the mystic lands of Tibet!

13) The Cretaceaous Period:

The last episode of the Mesozoic era was the Cretaceous period and it was a time when many of the typical Mesozoic life forms like ammonites, belemnites, gymnosperms, ichtyosaurs, plesiosaurs, pterosaurs and dinosaurs were in decline. But not before all of these groups of species branched out and diversified during some or most of their time and towards the end of the late Cretaceous period when they showed a variety of patterns of extinction.

Few changes have affected the landscape and ecology of the Earth more than the arrival of angiosperms, or flowering plants, approximately 130 million years ago. Flowering plants, which include hardwood trees and grasses, are distinguished from other plants by the flowers they produce. Although some are wind pollinated, most use color, scent or both to attract insects of various kinds. It is believed that

Nectar may have evolved as a reward for performing this function. Animals deliver pollen more efficiently than wind, so naturally plants that attract them improve their chances of reproducing. The origin of flowering plants during the early Cretaceous seems to have triggered a boom of insects; new groups, such as butterflies, moths, ants and bees arose and flourished. These insects drank the nectar from the flowers and developed in the case of the ants and bees highly complex colonial structures.

The mass extinction at the end of the Cretaceous period, 65 million years ago wiped out the dinosaurs along with every other land animal that weighed more than 25 kg. However it was less catastrophic than the previous mass extinction at the end of the Permian period yet it has attracted more research than any of the other extinction events. No one exactly knew just why and how the dinosaurs died out. But some light on the mysterious subject matter was shed back in 1980, when a notable article published in the journal Science by experimental physicist, Luis Walter Alvarez and collaborators that said that the Earth had been struck by an asteroid, 10 km in diameter 65 million years ago. Their evidence came from an iridium spike which is a rare element in the Earth's crust that is only present from meteor showers and the same phenomenon has been demonstrated at many more sections worldwide. This theory has been supported by a crater that was found in 1991 on the Yukatan Peninsula in Central America.

But more words on that event are in order.

Around 2011, paleontologists from the Yale University discovered the youngest dinosaur preserved in the fossil record before the fateful catastrophic meteor impact that took place that 65 million or so years ago. It must be mentioned here that this 15km wide meteor is known as the Chicxulub crater on the Yucatan peninsula in Mexico and it is believed that this meteor hit the Earth with a force one billion times more powerful than the atomic bomb at Hiroshima and impacted in such velocity that the blasted materials went at high rapidity into the atmosphere, triggering a chain of events that caused a global winter

which in affect blocked out the sun and caused a nuclear winter that killed off the plant life that the dinosaurs practically lived on. Also another theory suggest that, the collision produced a thermal pulse, a microwaving effect of the entire Earth in such a way that anything that was out on the surface, that couldn't hideaway in the ground, or go underwater, was basically fried, and hence the demise of the dinosaurs.

After this recent finding by the Yale University, scientists concerned are stressing on the fact that this discovery indicates that not only the dinosaurs did not go extinct prior to the impact due to climate change or changes in sea level, as some previous theories have proposed but also provides further evidence that the catastrophic impact was in fact the cause of their extinction. Triceratops is a genus of herbivorous Ceratopsid dinosaur which lived during the late Maastrichtian stage of the Late Cretaceous Period, around 68 to 65 million years ago in what is now North America. And the fossil was buried just five inches below the K-T boundary, precisely the geological layer that marks the transition from the Cretaceous period to the Tertiary period at the time of the mass extinction that took place 65 million years ago.

It must be mentioned here that the impact hypothesis for the demise of the dinosaurs was first proposed more than 30 years ago. And many scientists have come to agree upon the fact that the meteor caused the mass extinction and wiped out the dinosaurs from the face of the Earth, however, a shred of doubt surfaced along with that due to an apparent lack of fossils buried within the 10 feet of rock below the K-T boundary, popularly known as the 3-meter-gap theory. But many believe that this recent discovery in Montana re-ensures the fact that dinosaurs were well-alive right up until the asteroid impact. During the expedition in the Montana, the team thought the fossil was buried within about three feet of the K-T boundary, however the they were surprised to learn just how close to the boundary and hence, how close in time to the impact it was, clearly suggesting the idea that at least some species of dinosaur were still roaming the Earth as the meteor hit and as they say, went out with a bang.

14) The Palaeocene Epoch:

The Palaeocene was the earliest epoch of the Tertiary period, spanning the time between 65 and 55.5 million years ago. It is named after the Greek words palaois (old) and ceno (new), indicating the presence of new fauna and flora associated with the old ones from the Cretaceous era. The Palaeocene was a world without dinosaurs and turned out to be a crucial time in the history of mammals.

Mammals appeared first in the late Triassic, at about the same time as dinosaurs. Throughout the Mesozoic, most mammals were small, fed on insects and lead a nocturnal life, whereas dinosaurs were the dominant forms of life on land. After the abrupt changes about 65 million years ago, when dinosaurs disappeared with the exception of their descendants, the birds, the world was practically without larger sized terrestrial animals. This unique situation was the starting point for the great evolutionary success of the mammals. Only ten million years later, at the end of the Palaeocene era, they had occupied a large part of the vacant ecological niches, often competing with giant carnivorous birds, especially in South America. By this time, the landscape was teeming with small insectivorous and rodent-like mammals, medium sized mammals were searching the forests for any kind of food that they could cope with, the first large (but not yet gigantic) mammals were browsing on the abundant vegetation, and carnivorous mammals were stalking their prey.

Where and when the first primates, the group which we belong to, appeared remains uncertain, but the oldest confirmed primate fossils date to about 60 million years ago. It is widely agreed that primates emerged from archaic terrestrial and nocturnal insectivores (shrew-like animals) with early primates resembling lemurs or tarsiers and probably lived in trees in tropical or subtropical areas. Many of their characteristic features are well suited for this habitat, like hands specialized for grasping, with five digits and, in most primates, opposable thumbs, rotating shoulder joints and stereoscopic (three dimensional) vision. Other traits include a large brain cavity and nails

instead of claws. Modern primates range from Prosimians such as the pygmy mouse lemur, through the monkeys, to anthropoid apes such as the gorilla and humans.

15) The Eocene Epoch:

The epoch after the Palaeocene is called the Eocene and the root of such name comes from the Greek words eos (dawn) and ceno (new), meaning the dawning of new fossil forms. Towards the end of the Palaeocene and until about 50 million years ago in the early Eocene period, the global climate grew notably warmer. As a result, the range of the tropical type of vegetation expanded, pushing the tropical rainforest inside the Arctic Circle to create jungles at the poles. At the same time many of our present day fauna made their first appearance in the early Eocene period, including true primates and even and odd toed hoofed mammals (ungulates).

The oldest known fossils of most of the modern orders of mammals appear in a brief period during the early Eocene but all were small weighing about 10 kg. Both groups of modern ungulates (hoofed animals); the Artiodactyla and the Perissodactyla became prevalent mammals at this time. Horses began as small, four-toed woodland animals (Hyracotherium aka Eohippus) and underwent considerable changes to end as big one-toed grassland gallopers. Horses evolved in North America & colonized Europe in successive waves, only to become extinct in America prior to human arrival, and later reintroduced with the Spanish conquistadors back in 15th century. Most Perissodactyl lineages went extinct in the late Eocene or Oligocene but those that remained include the horses and zebras, rhinos, and tapirs.

One of the most fascinating creatures of this era is the dolphin, a being that still fascinates us with its sheer uniqueness and aptitude. Some words on dolphins are in order. Undoubtedly one of the significant mammals of this planet is dolphin, which belongs to an extraordinary branch of the aquatic creatures and considered as one of the most

intelligent species on Earth, especially in the water. With almost 40 different species and a process of evolution that took place for about 50 millions of years, dolphins, despite being one of the stars of the water kingdom, is in fact a lot like the creatures that roam on the solid surface of this 3rd planet from the mighty sun of ours. Why? Mostly because the ancestor (Pakicetus) of the dolphins about 55 million years ago lived on lands, looked a lot like wolfs which hunted in shallow waters and with the pass of time adapted itself to life in water and gradually the forelegs became flippers, the hind-legs disappeared and in came the fluke, the nostrils moved to the top of the head and of course the fur went way. And this is why dolphin babies are born with hair, just above their rostrum, which falls out immediately after their birth. Also perhaps why, as dolphin is not a fish, cannot breathe underwater even though bottle nose dolphins are able to hold breath underwater for 7 to 15 minutes. Also baby dolphins drink milk, as they are mammals and they are warm-blooded creatures just like us. Dolphins, much like us, are also a family oriented species, hang around in groups (ranging from 1000 to even a recorded 9000 in numbers) where family members, usually led by a female help each other in raising their young, traveling or in process of hunting and much more. Sometimes it was seen that even groups of different dolphin species unite and act together often to defend themselves against attacks of sharks. Between underwater and surface of the water body, how do dolphins sleep? Well, studies have found out that dolphins have to be conscious in order to breath and this means they cannot go into a full deep sleep because otherwise they will suffocate. So it was found that dolphins go to siesta by letting one half of their brain go sleep at a time! Dolphins, whose diet includes fishes, squids and other aquatic mammals, do not drink ocean water as it is too salty for them as it is to us. Instead, most of their water comes from their diet and also dolphins metabolize their body fat and water is released from that process and not only that, their kidneys are also designed to retain as much water as possible!

Amongst all the dolphin species, the smallest one is porpoise, up to 1.5 meter (5 feet) in length and 50 kg (110 pounds) in weight and the largest is the orca, male of which can 27 feet long and weighing 6 tons. Dolphins, who are also nature s one of the most prolific swimmers, have a wide range of special skills that are quite unique. For example, dolphins can see inside the bodies of their fellow dolphins and other aquatic creatures as well. And this is because dolphin sonar evolved to pass through water and it does not reflect until it hits something like bone or air sacs and since animal bodies are more than 50 per cent water, dolphins sonar enables them to literally "see through" inside other animals. And many scientists believe that this very fact allows dolphins to read the emotions of other dolphins as they can practically see through the bodies of other dolphins. It is understood that dolphins have great eyesight, they can both underwater as well as out-of-the water and they are able to hear frequencies which are 10 times above the upper limit of adult human hearing even though dolphins do not exactly have any ear and the hearing is practically done with the lower jaw which conducts sound to the middle ear via a fat-filled cavity in the lower jaw bone. And after all that talking and listening, dolphins are able to identify each other by their own distinct signature whistle!

One of the key reasons why dolphins are regarded as a very intelligent species because of its brain size. A dolphin s brain weighs about 2 kg (4.4 pounds) whereas a human brain weighs about 1.5 kg or 3.3 pounds. Does this mean that the bigger brain is for smarter animal? Not necessarily, but brain size do influence the level of intelligence. One interesting fact is in the case of the dolphin, the auditory areas are more developed than in humans mostly due to their complicated ultrasound sonar used for mapping the environment. The dolphin's brain has 2 kg (4.4 pounds), more than a human brain (which has about 1.5 kg or 3.3 pounds) and displays the same complicated grooves pattern. A dolphin weighing 120 kg (280 pounds) has a 1.7 kg (4 pounds) brain. Archaeological data show they have been having these big brains for millions of years. But there are differences between a

dolphin and a human brain: in the case of the dolphin, the auditory areas are more developed than in humans (due to their complicated ultrasound sonar used for mapping the environment).

The cortex is relatively less developed than in humans and the neuron's density is lower than in terrestrial mammals. It can be safely stated that dolphins are certainly not smarter than humans but they sure do care about them though. There were numerous cases of dolphins defending shipwrecked people swimming in the water from shark attacks till rescue ships appeared and real cases of people being saved from drowning by dolphins are quite well known from ancient Greek and Roman stories to the legends of the Polynesians and Maori of the New Zealand to the modern day tales of human rescue by dolphins. There were incidents when dolphins carried people for more than 20 miles of ocean to the shore or protected the victim from shark attacks. Needless to say dolphins never attack or hurt humans in any way but humans have been hunting and killing dolphins relentlessly and this extensive killing have caused many species like Amazon River dolphin and the Ganges and Yangtze River dolphin to go seriously endangered. Besides massive sea pollution and other environmental degradation have also caused dolphins, along with other aquatic creatures a great deal of misery. Efforts must taken much more seriously and with great concern so that such wonderful creatures do not get harmed in any way and maintain a peaceful coexistence with all the wonders of the nature, both sea and land based.

Few words need to be mentioned about whales of this era as well. Whales are considered to be one of evolution's great enigmas. After life went to all the trouble of adapting to dry land, some mammals decided life was better off in the water after all. Most of the fossil evidence suggests that the distant ancestors of whales were Mesonychids, which underwent a radical change of habitat. Mesonychids were hoofed, hyena-like, land-dwelling mammals, the size of wolves, but had skull the size of bear skulls. They had four short legs, big feet, and 5-8 centimeter notched, triangular teeth similar

to those of early predatory whales. Another early ancestor of the whale, Ambulocetus, may have evolved from Mesonychids.
This fossil of Ambulocetus natans, meaning walking whale that swims was discovered in 1993 and showed that its back feet were bigger than those in the front. Although Ambulocetus was still clearly a Tetrapod, its ear capsule was isolated from the rest of its skull, just like that of a modern whale, with powerful jaws and shark-like teeth, a small brain, and a pelvis fused to its backbone. But going back to the oceans required many adaptations for living in the water, including a backwards and upwards shift of the nostrils, coverings for the nostrils, a streamlined shape, loss of the rear limbs, change of the forelimbs into flippers, addition of flukes for swimming, modification of senses for use in the water, loss of most hair, and addition of a layer of insulating blubber.

16) The Oligocene Epoch:

The Oligocene epoch of the early Tertiary period, spanned the time between 33.7 and 23.8 million years ago, somewhat a relatively short span of time, even though a number of changes occurred during this time. These include the appearance of the first elephants with trunks and the appearance of many grasses, plants that would eventually produce vast tracts of grasslands in the following epoch, the Miocene.

At the beginning of the Oligocene the world was growing rapidly cooler and more seasonal. But waves of extinction overtook the mammals that had been better suited to the more tropical world of the earlier Eocene. By the early Oligocene era, the polar broad leaved deciduous forests were gone and Antarctica was ice capped. In the oceans, some of the marine biotic provinces became more fragmented as marine life capable of withstanding cooler temperatures congregated to places further from the warmer equator, where other species could better survive.

The now much cooler and drier climate augmented the evolution of grasses, which became one of the most important groups of plant

organisms on the planet. As they spread extensively over several million years they fed herds of grazing animals gave shelter to smaller animals and birds, stabilized the soil and which reduced erosion. They are high fiber, low protein plants and must be eaten in large quantities to provide adequate nutrition. But since they contain tiny silica fragments they wear animal teeth down. And this in turn drove the evolution of grazing animals with teeth adapted to cope with such a diet e.g. the more recent horses such as Merohippus.

In Western Europe, a sudden change in the fauna, known as the Grand Coupure, occurred. And this refers to the time near the end of the Eocene era when many faunal groups, including primates, became extinct in the Northern Hemisphere and got involved in the immigration from areas to the east. During this time at least 17 generic extinctions, 20 first appearances, and 25 unaffected genera of mammals are represented across the Eocene-Oligocene boundary in Western Europe. The late Oligocene period, marked by the expansion of grasslands saw domination on land by mammals such as horses, deer, camel, elephants, cats, dogs, and primates. Based on the study of some DNA evidence suggests that the ancestors of modern apes and humans evolved between 22 and 33 million years ago, but abundant fossils do not appear until the Miocene eon.

17) The Miocene Epoch:

The Miocene was named from the Greek words meion (less) and ceno (new) and during this period there were less new fossil forms than during the following epoch, the Pliocene. At this era, communities of large brown algae, called kelp, supported evolving marine life, such as sea otters, as well as established groups of fishes and invertebrates. Plant studies of the Miocene era that was focused primarily on spores and pollens show that by the end of the Miocene 95% of modern seed plant families existed, and that no such families have gone extinct since the middle of the Miocene. A mid-Miocene warming, followed by a cooling is considered responsible for the retreat of tropical

ecosystems, the expansion of northern coniferous forests, and increased seasonality.

The overall pattern of biological change for the Miocene is one of expanding open vegetation systems (such as deserts, tundra, and grasslands) at the expense of diminishing closed vegetation (such as forests). Mammals and birds in particular developed new forms, whether as fast-running herbivores, large predatory mammals and birds, or small quick birds and rodents. Horses first appeared in the early Eocene as cat sized herbivores, feeding on leafy vegetation. As coarse grasses replace the woodlands during the Oligocene some species evolve larger jaws and deep rooted teeth with protective enamel. They also evolve larger guts, to be able to digest the large quantities of grass. The grazing Oligocene horses are now larger with longer legs and hooves that enable them to run faster than those with padded feet. They quickly spread from North America to Europe and Asia and from there to Africa where some species become today's horses.

18) The Pliocene Epoch:

The final epoch of the Tertiary period is called the Pliocene epoch and is named after the Greek words Pleion (more) and Ceno (new) meaning that there were more new fossil forms than previous epochs. At this stage the primates continued to diversify and humans and chimpanzees shared their last common ancestor around 7 million years ago, and have since followed separate evolutionary paths. We share about 98.8% of our DNA with chimpanzees, which are thus our closest relatives amongst the primates. The first known hominids or humanlike primates evolve in eastern Africa about 5.2 million years ago. Hominids feature prominent jaws and most species have large brains relative to those of apes. Most hominids probably lived in groups either in or near forests and some later species made and used tools. The oldest fossils discovered in 1974, a jawbone teeth and a toe bone found in Ethiopia, date back to 5.3 million years and she was named Lucy . And these earliest hominids could walk upright on two

legs and this adaptation afforded certain advantages such as the ability to see over the top of high vegetation and to easily carry food or tools and weapons while traveling.

19) The Pleistocene Epoch:

The Pleistocene was the penultimate epoch of the Quaternary period, spanning the time between 1.8 million years ago up to the beginning of the Holocene at 10,000 years ago. It is named after the Greek words Pleistos meaning most and Ceno meaning new fossil forms and the Pleistocene fossils are a great source in understanding the climates of the past as Pleistocene was a time during which climates and temperatures shifted dramatically; Pleistocene fossils are often abundant, well-preserved, and can be dated very precisely. The Pleistocene fauna included giant marsupials, such as the rhino-sized wombat-related Diprotodon, the giant monitor lizard Megalania and New Zealand's giant flightless bird Dinornis maximus that reached a height of 3 meters. The Pleistocene also saw the evolution and expansion of our own species, Homo sapiens, and by the close of the Pleistocene, humans had spread through most of the world. A fossil jaw found in Mauer, Germany, of Homo Heidelbergensis dates these early humans to approximately 500,000 years ago. They display physical characteristics of modern humans, with an increased brain capacity, smaller teeth and a face that slopes less than that of other hominid ancestors. About 130,000 years ago modern humans (Homo sapiens) dispersed throughout Africa, the Middle East and Europe. They were characterized by a more gracile skeleton, and higher, domed skull than their European contemporaries, the Neanderthals. Cave paintings suggest that by 40,000 years ago they had developed a sophisticated culture; some authors equate this to the appearance of complex spoken language.

20) The Holocene Epoch:

The final epoch of the Quaternary period, spanning the time from the end of the Pleistocene (10,000 years ago) to the present is the

Holocene epoch, named after the Greek words Holos (entire) and Ceno (new), indicating it contains entirely new fossil assemblages. Even though Holocene period is sometimes referred as the Age of Man but modern humans evolved and spread over the planet well before the Holocene began. However, since the rise of the first civilizations, perhaps 12,000 years ago, humans have influenced the global settings in a manner quite unlike that of any other organism and matured enough, over time, to ponder over the life on many different planets with logic and reason. And that s been quite a spectacular journey.

The Brain Factor

But to what do we exactly owe our massive extent of success? Some say it is the miraculous development or rather the evolutionary progress of our brain that made us the dominant one of all the species of this big blue planet. It is now believed that of all the mysterious aspects of the known Universe, the sophistication and the puzzling nature of the human-brain indisputably rank no.1. It is said that the complexity of human-brain parallels to that of the grand design of the cosmos itself! If mankind has indeed come a long way, then our brains certainly have endured a lot more and much of the ancient wonders of nature that left this wonderful planet so many millions of years ago. This magnificent organ that weighs approximately 1.4 kg, is single handedly responsible for every thought, action, memory, emotion and experience which also contains a mind-boggling one hundred billion nerve cells, equivalent to the number of stars in our very own galaxy. But before that, few words in regard to the brain nerve cells are in order. The brain nerve cells or neurons are basically microscopic electrochemical switching elements sizing a few hundredths of a millimeter across an electrically excitable cell that processes and transmits information by an electrical and chemical signaling process. And this specialized, impulse-conducting cell is central to the proper functioning of the body's nervous system, and thus the sound survival of the entire human body.

Our brain, which took over a million years to develop, evolved from inside out. The oldest part of our brain, the brainstem, conducts our most basic biological functions like breathing, the tempo of heart rate along with other physiological systems that are independent of conscious brain functions. And on the ceiling of this ancient most part of the brain lies the R-Complex, a primitive system, common in other reptiles that sternly dictates our sense of aggression, ritualistic behavior, territoriality and communal hierarchy. It is this very part that was developed hundreds of millions years ago in our ancient reptilian ancestors. This part of the brain is responsible for the constant reminder that, despite our fancy TV programmes, cache of designer attires and scholastic marvels, we were, are and will always be one of the fierce competitors of the creature kingdoms. Neighboring this animalistic part, resides the limbic system or commonly referred to as the mammalian brain which took tens of millions of years to evolve in our pre-historic ancestors who were at that point in time still mammals and not yet our ancestral primates. We owe our sense of mood, concerns and emotions to this particular part of the brain. Right adjacent to this care centre, we have the cerebral cortex, which took millions of years to evolve into the brain system of our ancestral primates and it is the realm of consciousness, memory, awareness of all kinds, thoughts, intuition, analysis and judgment, languages and much more. It is the gray matter of the brain (due to its grayish appearance) that commands the two third mass of the entire human-brain and is solely responsible for making human beings the most dominant of all species on the planet Earth. Out of the calling of this cerebral cortex, mankind embarks upon his historic cosmic voyages to foresee the future, study fossils to eavesdrop into the past and ponder over the contemporary sphere of space and time in such a pensive state that it often leads to great products, like Einstein's Theory of Relativity, Led Zeppelin's Stairway to Heaven and Satyajit Ray's silver screen stellar Pather Panchali . To be simple and precise, we make sense as human beings because of the presence of the cerebral cortex in our brain.

The complexity of the nature of human brains took a lot of time to be properly understood and experts say, so far we've realized only the tip of the iceberg as far as the mechanism and the elite power of human brain is concerned. In the 4th century B.C. Aristotle thought brain was a secondary organ and acted as cooling agent for the heart, which according to his opinion, was the centre of human intellect. Needless to say human beings have come a long way since that (or have we really?). In layman's terms, we understand that our brain is made up of 75 percent water, utilizes 20 percent of the total oxygen of the human body and contains about 100,000 miles of blood vessels and as there are no pain receptors in the brain, the human-brain itself cannot feel any pain. The brain requires that 20 percent oxygen for the maintenance of cell-health and to energize electrical impulses that neurons employ to communicate with one another and also 6.750 ml of blood is pumped through our brain every minute, which is 15-20 percent of the blood flow from the heart. While awake and in a full-functioning state, our brain generates about 10 to 23 watts of electricity, enough energy to power a light bulb, hence the popular projection in cartoons, the appearance of bulb when the character suddenly gets an idea. Contrary to the popular urban legend, human-beings do not use only 10 percent of their brain or less which is nothing but a common misconception as experts believe that despite numerous unsettled mysteries of brain, every part of the brain has a purpose.

It is now commonly known about the two hemispheres of human brain that, the right side, which is responsible for creative insights, intuitions, sensitivity and pattern recognition, controls the left side of the body whereas the left side of the brain which organizes the rational, analytical and critical thinking processes, controls the right side of the human body. Not bad for an organ which generates an average of 70,000 thoughts daily in each human being. Experts believe that the total information content of the human brain, if expressed in bits, will probably be comparable to the total number of connections among the

neurons, which is about 100 trillion bits. Studies have found that if this information is penned down, it is believed that the data will fill up some 20 million volumes of books. This means that in each of us has an equivalent of 20 million book's worth of information stored in our brains! And precisely here lies the splendor of all questions-- what do we do with this information? How do we apply this knowledge for the betterment of all? Given the history of mankind that is embedded with battles and wars, it seems we are yet to master the true power of our most crucial organ. Blessed with something that is as complex, yet as grand as the Universe itself, perhaps, it could certainly do much better with just a little guidance from our good old hearts after all.

But was this supremacy of human beings, of course thanks to the power of our brains, a predetermined factor? Experts believe that the rise of human beings took place, rather, as an unexpected outcome and conditional result of thousands of linked events and scenarios. And had any one of those scenarios have occurred any differently then we would not be here today trying to make sense of the world and the Universe. Let s consider few examples in this regard. Firstly, if our inconspicuous and fragile lineage had not been among the few survivors of the initial radiation of multi-cellular animal life in the Cambrian explosion 530 million years ago, then no vertebrates would have inhabited the earth at all. Secondly, if a small and unpromising group of lobe-finned fishes had not evolved fin bones with a strong central axis capable of bearing weight on land, then vertebrates might never have migrated to lands. Thirdly, if a large extraterrestrial body had not struck the earth 65 million years ago, then dinosaurs would still be dominant and mammals would have remained insignificant and frequently preyed upon. Ant the fourth argument is that if a small lineage of primates had not evolved upright posture on the drying African savannas just two to four million years ago, then our ancestry might have ended in a line of apes that, like the chimpanzee and gorilla today, would have become ecologically marginal and probably doomed to extinction despite their remarkable behavioral complexity.

Life itself: the Spark that Fueled the Fire

After all this has been said and done and after this comprehension of evolutionary process of life on Earth and the stories of the successes of hers at so many different stages of this planet s geological history, how life itself emerged on planet Earth at the first place? How Earth, from a non-living planet, came out as a living one? What is the true story of materialization of life from absolutely non-life matters? What commenced the life process which eventually triggered the age of invertebrates followed by an age of fishes to age of reptiles , age of mammals and finally the age of man over the span of millions of years? The fact is scientific hypotheses about the origins of life can be divided into several kinds and in order to understand how self-replicating molecules or their components came into being at the first place requires comprehension of several ideas that offers some understanding towards this great mystery.

There s this theory that life comes from non-living matters and it is called spontaneous generation theory, an idea which dates back to the time of Aristotle. The classical ideas of spontaneous generation, which can be considered under the modern term, abiogenesis, says that living organisms are generated from the decaying matter of other organic substances. Aristotle believed that this theory has a considerable extent of readily observable truth into it and as for proof; he used to point out that aphids arise from the dew which falls on plants, flies from putrid matter, and mice from dirty hay and crocodiles from rotting logs at the bottom of bodies of water. Although this idea gained some acceptance over the following centuries at that era of time but for the first time in 1668 came the first experimental evidence against spontaneous generation theory. The Italian physician, naturalist and poet Francesco Redi, in one experiment, showed that no maggots appeared in meat when flies were prevented from laying eggs which means that decaying meat itself will not produce any kind of life forms on its own if situation prevents other organisms to spawn and procreate keeping the decaying meat as their home center for their reproduction

process. And gradually it was found that, at least in the case of all the readily visible organisms, the previous idea regarding the spontaneous generation was incorrect which eventually led to the alternative of abiogenesis theory and the commencing of the much accepted biogenesis theory that states that every living thing came from a pre-existing living thing.

Some better understanding along the line of biogenesis started to appear around 1871 when an English naturalist and geologist named Charles Darwin nourished the idea that life may have begun in a warm little pond, with all sorts of ammonia and phosphoric salts, lights, heat, electricity, etc. present, so that a protein compound was chemically formed ready to undergo still more complex changes . But Darwin, best known for his contributions to evolutionary theory which states that all species of life have descended over time from some common ancestors and this branching pattern of evolution resulted from a process that he called natural selection, believed that at the present day (referring to the 19th century time when he was working on this subject matter) that such matter would be instantly devoured or absorbed, which would not have been the case before living creatures were formed . However this particular idea of Darwin eventually triggered the thought that perhaps more can be learnt on the spontaneous origin of life in the sterile conditions of the laboratory through the artificial production of organic compounds that favored the condition of the birth of life at the first place.

In 1924, a Soviet biochemist named Alexander Oparin argued that a primeval soup of organic compounds could be created in an oxygen-less atmosphere through the action of sunlight and these would combine in ever more complex ways until they formed coacervate droplets (a coacervate is a tiny spherical droplet of assorted organic molecules which is held together by hydrophobic forces from a surrounding liquid). Afterwards these droplets would grow by fusion with other droplets, and reproduce through fission into daughter droplets. And this will lead to a primitive metabolism in which those

factors which promote cell integrity , will survive and those that do not, become extinct. According to experts, many modern theories and experiments concerning the origin of life still take Oparin's ideas as a starting point. During somewhat the same time, J. B. S. Haldane, a British geneticist, biometrician and physiologist, suggested that the Earth's pre-biotic oceans, much different from their modern counterparts, would have formed a hot dilute soup in which organic compounds could have formed which gradually led to the coming of life on planet Earth.

Perhaps the most important experiment concerning this primordial soup theory came in 1952 when an American Chemistry student, Stanley Miller and his professor, Harold Urey, performed an experiment that demonstrated how organic molecules could have spontaneously formed from inorganic precursors, under conditions like those hypothesized by the Oparin and Haldane. The now-famous Miller Urey experiment, that took place in 1953, used a highly reduced mixture of gases, namely methane, ammonia and hydrogen to form basic organic monomers (monomers are the building blocks of more complex molecules, called polymers) such as amino acids. In that famed experiment, a mixture of water, hydrogen, methane, and ammonia was cycled through an apparatus that delivered electrical sparks to the mixture. After one week, it was found that about 10% to 15% of the carbon in the system was now in the form of a balanced mixture of organic compounds, including amino acids, which are the building blocks of proteins, an essential biological molecule for life forms. Although life certainly did not developed from this particular experiment but sure gave a factual idea on how it might have developed on Earth at the first place millions of years ago.

Another proposed theory on the arrival of life comes from this idea which states that tidal processes that might have occurred during a time when the moon was much closer to Earth may have concentrated, to a certain extent, the grains of uranium and other radioactive materials at the high-water mark (a high water mark is a point that represents the

maximum rise of a body of water over land) on primordial beaches, where they may have been eventually responsible for generating life's building blocks. According to computer generated experiments conducted keeping this particular theory in mind, it has been found that a deposit of such radioactive materials could show a self-sustaining nuclear reaction and out of that reactionary process, such radioactive beach sand might have provided sufficient energy to generate organic molecules, such as amino acids and sugars. And this radioactive process also might have released soluble phosphate into the regions between sand-grains, making it biologically accessible and thus amino acids, sugars, and soluble phosphates might have been produced simultaneously and these complexes could have been important early catalysts to the living processes that we are so familiar of today.

There is another argument on the origin of life which centers on the deep sea vent, or alkaline hydrothermal vent (a hydrothermal vent is a fissure ((a long, narrow opening or line of breakage made by cracking or splitting, especially in rock or earth)) in a planet's surface from which geo-thermally heated water comes out) theory. This theory suggests that life may have begun at submarine hydrothermal vents, where hydrogen-rich fluids emerge from below the sea floor, as a result of serpentization (a geological process whereby rock is changed, with the addition of water into the crystal structure of the minerals found within the rock). And this serpentization took place with olivine reaction (the mineral olivine is a magnesium iron silicate with the formula) with sea water and a pH interface with carbon dioxide-rich ocean water, all of which created a life generating scenario for the early Earth.

Another idea on the origin of life is the RNA world hypothesis. This idea describes an early Earth with self-replicating and catalytic RNA but no DNA or proteins which in fact spurred scientists to try to determine if RNA molecules could have spontaneously formed which were capable of catalyzing their own replication on their own. There are evidences that suggest chemical conditions (including the presence

of boron, molybdenum and oxygen) for initially producing RNA molecules may have been better on the planet Mars than those on the planet Earth. And if that certainly was the situation then, life-suitable molecules, originating on Mars, may have later migrated to Earth via panspermia (a hypothesis that life exists throughout the Universe, distributed by meteoroids, asteroids, comets and planetoids. or similar process).

Continuing with another panspermia theory which basically goes like this. It is understood that organic compounds are relatively common in space, especially in the outer solar system where they are not evaporated by solar heating. Comets are encrusted by outer layers of dark material, thought to be a tar (which is a substance obtained from a `variety of organic materials through destructive distillation) like substance composed of complex organic material formed from simple carbon compounds after reactions initiated mostly by irradiation by ultraviolet light. Many suppose that a rain of material from comets could have brought significant quantities of such complex organic molecules to Earth which commenced the flourish of life here.

Another idea related to panspermia theory is that extra-terrestrially formed amino acids made their way onto Earth via comets and eventually influenced directly on the development of life. In 2009 it was announced by NASA that scientists had identified one of the fundamental chemical building blocks of life in a comet for the first time called glycine, an amino acid that was detected in the celestial material ejected from Comet Wild-2 in 2004 and collected by NASA's Stardust probe. Tiny grains, just a few thousandths of a millimeter in size, were gathered from the comet and returned to Earth in 2006 in a sealed capsule and upon examination it was found that the glycine signature discovered in Stardust's sample bay was genuine and not just earthly contamination. According to Dr. Carl Pilcher of NASA's Astrobiology Institute, who was involved in that research, The discovery of glycine in a comet supports the idea that the fundamental

building blocks of life are prevalent in space, and strengthens the argument that life in the Universe may be common rather than rare.

In 2011, a finding by NASA, based on studies of meteorites found on Earth, suggests DNA and RNA components (adenine, guanine and related organic molecules), building blocks for life as we know it, may be formed extra-terrestrially in outer space. In October 2011, scientists reported that cosmic dust contains complex organic matter (amorphous organic solids with a mixed aromatic-aliphatic structure) that could be created naturally, and rapidly, by stars and scientists believe that these compounds may have been related to the development of life on Earth. In 2012, astronomers at Copenhagen University reported the detection of a specific sugar molecule, glycolaldehyde, in a distant star system. The molecule was found around the protostellar binary IRAS 16293-2422, which is located 400 light years from Earth. And it is understood that Glycolaldehyde is needed to form ribonucleic acid or RNA and this finding suggests that complex organic molecules may form in stellar systems prior to the formation of planets, eventually arriving on young planets early in their formation.

Back in the early 90 s there was also this idea that life initially occurred through autocatalytic chemical networks. And this idea suggests that as autocatalysts are substances that catalyze the production of themselves, therefore those early chemical components had the property of being simple molecular substances that could replicate themselves to generate life. A few years before that, in 1985, Alexander Graham Cairns-Smith, an organic chemist and molecular biologist at the University of Glasgow, proposed that life originated from clay and his hypothesis suggested that complex organic molecules arose gradually on a pre-existing, non-organic replication platform of silicate crystals in solution. And some few years before that sometime during 1970s, Thomas Gold, an Austrian-born astrophysicist, a professor of astronomy at Cornell University proposed the theory that life first developed not on the surface of the Earth, but several kilometers below the surface. It is now quite well established

that microbial life is plentiful at shallow depths in the Earth, up to 5 kilometers (3.1 miles) below the surface and these findings gave Gold s deep-hot biosphere model a certain extent of credibility.

And lastly there is the controversial Gaia hypothesis, an idea coined by scientist James Lovelock and further developed by microbiologist Lynn Margulis in 1970s, which states that organisms interact with their inorganic surroundings on Earth to form a self-regulating, complex system that contributes to maintaining the conditions for life on the planet. And as for argument on behalf of it, it has been pointed out the very way the biosphere and the evolution of life-forms affect the stability of global temperature, ocean salinity, oxygen in the atmosphere and other environmental variables that affect the habitability of Earth.

One Earth to Many

It s amazing how far we have come from simple organisms roaming in ancients of aquatic ecosystem. Now looking back, it s simply wondrous and even triggers the thought, was it all meant to be? We have received some ideas on how it all happened; maybe someday we will realize for sure why it all happened. Was there ever a greater meaning to all of these evolutionary processes? Perhaps life evolves for life s own sake and that s the persistent nature of life itself. It is there because it evolved and it evolved because it is there. And maybe we are just pawn to this great game of life and we are simply at life s disposal in this grand arena cosmological splendor. But we sure are grateful and content that we are all here at this day and age where slowly and gradually the mysteries of the Universe are coming into light. While our understanding on how life began on Earth and in due time how it evolved into what it is today is somewhat within our intellectual approach, we believe at the same time knowledge on the possibility of the evolution of life elsewhere in the Universe will be realized in no time.

We and the possible extra-terrestrial life forms live in the same Universe. As a result of similar cosmic laws applies to all life forms, at least to a great extent, no matter where their locales are. But this also doesn t mean that extra-terrestrial life on other planet has the similar chemical or biological structure, exactly like the kind we have on our own planet which tells us that perhaps it is not wise to expect either similar or familiar organisms in other locales of the Universe.

If we consider our planet in this regard we see that although all Earthly creatures share the same planet and an identical molecular biology but there exists this massive diversity of living things on Earth. And it will be absolutely logical to see that by that very nature, the creatures and organisms of extra-terrestrial origins are probably vastly different from any Earthly organism we know today. Astro-biologically speaking, there are many arguments on what extraterrestrial life would be like. There are some who believe that all life is like life on Earth that is carbon-based life forms while there are others who believe silicon and even ammonia-based life forms could exist in other planets. And that ought to influence the evolutionary process of extraterrestrial creatures and should precisely mark the difference, as far as the looks and biological structures of other planetary beings are concerned.

We are yet to discover for absolute certainty that there is this planet or number of planets that shows signs of extra-terrestrial life. But there are quite a few promising ones. By studying our own planet and examining those possible ones we are likely to understand the origin and evolution of life on those distant cosmic planets. But that certainly is a long way to go. It took millions of years for us to evolve into this stage. Chances are in some of those planets, the process of evolution commenced much earlier than ours and their evolutionary progression took them to a new height where they are much more intellectually superior to us and exercise an advanced extra-terrestrial civilization. And then again there are chances that their planetary condition was in such a state that their beginning of life commenced much later than ours and they seem to be only at the beginning stages of evolutionary

process. And their story has just begun. Either way, there are indeed planets out there, much like our own, where life, as we read this, is in an evolutionary process, exactly as we are right now. Either they are more evolved than us or we, the Earthlings are comparing to them. But where those planets are and who are they and what do we know about them? How to look for them and what are we doing to search for our cosmic neighbors? In this massive galactic vicinity it s not an easy matter to see signs of life and intelligence out there. But efforts are underway and promises are out there. The truth is we are not alone and the stellar magic of life is surely out there somewhere awaiting our discovery. So let us look at what we know so far about our quest for extra-terrestrial lifer forms, intelligent or otherwise.

Chapter-5 (Calling All Aliens)

The Quest beyond the Sky

So where do we look for signs of extra-terrestrial life-forms? It must be understood that our magnificent splendor of Universe is unbelievably big. Even though when we gaze up at the mighty sky and see countless assembly of stars, planets, galaxies and much more however as far as the cosmic inventory goes, it has been found that an astounding 72% of the Universe is covered with dark energy, 23% with dark matter and the rest, just only 5% consists of the familiar visible matters that shape up these stars, planets and galaxies. Before getting into the focal point of this chapter, perhaps it is important to pen down few words in the honor of the dark aspects of our Universe, after all they jointly make up 95% of it. To put it simply, dark energy is the hypothetical form of energy that is chiefly responsible for the accelerating rate of expansion of our Universe. And dark matter is the theoretical matter that is believed to exist from the gravitational effects on visible matters and background radiations but thought to be undetectable by emitted or scattered electromagnetic radiation.

Now let s get back to our search for extra-terrestrial intelligence and let us ask one more time; are we alone in the Universe? This olden question has been asked by human beings all over and the ever-expanding enormity of the Universe only enhanced a sense of mystic ambiguity on the issue. By now it is certainly understandable that life is a delicate matter in its own right. Experts believe that some planets might support complex organic molecules like proteins and nucleic acids and absolutely nothing else while there could be other planets out there in the Universe that might support simple, single-celled organisms. And furthermore there could be planets out there that may very well support multi-cellular organisms, including those advanced enough to develop the technologies to travel and send signals into

outer space, very much like our own! We understand that as the human intelligence matured and science and technology progressed, this utmost curiosity towards the heavens relentlessly encouraged mankind to interpret the wonders of space and her splendid elements. And all along the hope for a friendly celestial neighbor have been treasured by all of mankind, in almost every astronomical endeavor of his, throughout the ages. And as a continuation of that process, for the last hundred years or so, scientists, with both passion as well as reason, have asked whether it is mathematically possible to determine the actual existence of an extra-terrestrial civilization. And perhaps the true pioneer in this regard is none other than Frank Drake, the great American astronomer and co-founder of SETI Institute, (Search for Extra-terrestrial Intelligence, Institute) who pioneered the scientific search for intelligent extra-terrestrial life-forms, but more on the SETI, the organization itself later and for the moment let s understand about the crucial contribution Frank Drake made in the science s quest for extra-terrestrial life-forms.

The Drake Equation

Back in 1961, the young radio astronomer Dr. Drake devised a mathematical formula which survived the test of time and remained a key equation to estimate the number of communicable extra-terrestrial civilizations in the Milky Way galaxy alone. This mathematical formula, now popularly known as the Drake Equation, basically looks like this:

N = R x fp x ne x fl x fi x fc x L

Here, N is the number of detectable civilizations in our galaxy. The other variables are described below:

R is the rate of star formation in the galaxy

fp is the fraction of stars that form planets

ne is the number of planets hospitable to life (i.e., Earth-like planets)

fl is the fraction of these planets on which life actually emerges

fi is the fraction of these planets on which intelligent life arises

fc is the fraction of these planets with intelligent beings capable of interstellar communication

L is the length of time such a civilization remains detectable

And when we explain the equation, we have this following. *R* represents the rate of the star creation in our galaxy which is about 7 per year. And this is multiplied by *fp*, the fraction of those stars that have planets and according to one estimation; 20-60% of such stars house planets. Next in the line of the multiplication process is *ne*, which is the average number of planets that can potentially support life per star that has planets. The number of such planets varies but believed to be around 1 to 5. Then comes *fl* which is the fraction of the above that actually go on to develop life and this is followed by *fi*, the fraction of *fl*, where intelligent life actually develops. Next in line in equation is *fc*, the fraction that projects detectable sign of their existence as well as level of intelligence into space. And the last in the line of the multiplication process is *L*, which is the expected lifetime of such intelligent civilization in order to be able to communicate and receive messages from other civilizations across the interstellar space. This last one is the delicate of all. And it is because, considering the expected lifetime of Earth which is another 7.5 billion years (by then Earth is estimated to be consumed by the Sun) and so far our planet have projected the radio wave communication abilities in just less than 100 years, many strongly wonder how long our present civilization will last before we kill ourselves. And what guarantee is out there that same is not taking place in some other distant cosmic civilization? And that s exactly where the delicate nature of the last part of the Drake Equation lies.

But despite all the uncertainties, challenges and delicate natures of the equation, this formula actually gives an answer and that is *N*, which is the total number of communicable intelligent civilizations in our Milky Way galaxy, and that is somewhere between 1000 to 10,000 to up to

100,000,000! But many believe 10,000 is perhaps the correct estimation. Now whether these civilizations will communicate with Earth in any time soon is another argument but many speculate that this Drake Equation is a great way to aid in mankind s quest for extra-terrestrial life-forms and a very inspiring one at it as well.

The Science of the Seeking

We have learned in a previous chapter (Echoes from our Solar District) on the possibilities of other planetary life-forms within our own solar system. But what about what lies beyond our own solar vicinity? Drake Equations predicts on the possibility of hundreds of planets that supports not only life but also intelligent civilizations as well in our Milky Way galaxy alone. And there are hundreds of billions of galaxies in this Universe. And astro-biologically speaking, there are indeed some extra-solar systems (solar systems that are located beyond our own) that shows great promise as far as housing Earth-like planets with possible intelligent life-forms are concerned.

And one such is Gliese 581 star system.

But first let us understand in few words on two crucial factors that will assist us in our comprehension of the scientific ways of searching for life elsewhere in the Universe. First one is, exactly what is an Earth-like planet? In usual terms it refers to a planet with approximately the same size, composition, and temperature as our Earth. Such a planet is thus, believed to be potentially habitable, just as our own planet is. By this definition, as we have seen earlier, there are no other Earth-like planets in our own solar system but there are likely to be millions of exo-planets (a planet which orbits a star outside our solar system) in our Milky Way galaxy that may meet these above mentioned criteria.

Secondly, what is astrobiology and how is it different from exobiology? Astrobiology is the multidisciplinary study of life in the universe. It addresses some very basic questions: How does life begin? How common is life in the universe? How can we detect extraterrestrial life? And what is the future of life on Earth and

beyond? Astrobiology research draws upon the aptitude of scientists from many different fields, including astronomy, astro-chemistry, planetary science, geology, biology, biochemistry, and genetics. The word astrobiology was introduced in the middle 1990s, and it has largely replaced the older term exobiology. Although the two terms are often used interchangeably, but astrobiology formally includes the origin and history of life on Earth, while exobiology is more focused on life beyond the Earth. Astro-biologists believe that study of life on Earth is one of the best ways to learn to identify habitable environments elsewhere.

Promises of Gliese

Now getting back to the Gliese star system, located 20.3 light years away from the Sun, residing in the constellation of Libra, Gliese 581 is a red dwarf star (the 117th closest star to Earth and one third strength of our Sun) that is believed to be supporting a system comprised of six planets. Gliese 581 has been repeatedly associated with housing Earth-like planets from time to time by astronomers. And Gliese 581d is the 3rd planet of that famed solar system, the 5th in the order from the star, now believed to be residing in the habitable zone (the right distance from a parent star where a planet, much like the Earth, can maintain liquid water on surface and thus harbor life). Initially, it was perceived that Gliese 581d was too cold to sustain life, but as the research went on it proved to be a strong candidate for an extra-solar Earth-like planet.

It is understood that Gliese 581d is a rocky planet with a mass at least seven times that of Earth and about twice its size and receives less than a third of the solar energy than that of our blue planet and also believed to be tidally locked with a permanent day and night side. Initially, because of this, it was thought the planet was, both, too cold and too hot to sustain life. But to test this idea more in depth, in 2011, a team of scientists from the Institut Pierre Simon Laplace (CNRS, UPMC, ENS Paris, Ecole Polytechnique) in Paris, France developed a computer model, which is capable of more accurately determining the

climate of a exo-planet by stimulating the planet's atmosphere and surface in three dimensions, very much like those that are used to study the climate change here on Earth.

The study found out that, having dense carbon dioxide, which is a likely scenario in a large planet, the climate of Gliese 581d is both stable and warm enough to have oceans on its surface as well as clouds and rainfall! One key factor in the research is the consideration of Raleigh scattering, which gives its bluish appearance in our sky. It was found that as the starlight (solar rays) from Gliese 581 is red and unaffected, it can penetrate much deeper into the atmosphere of Gliese 581d, where it heats the planet (for good) effectively due to the greenhouse effect of the carbon dioxide-rich atmosphere. Besides, the 3D circulation simulations also showed that the daylight heating was efficiently redistributed across the planet by the atmosphere, preventing atmospheric collapse on the night side or at the poles.

Although previously it was believed that Gliese 581d is too hot and too cold (respectively) to sustain life but further research ultimately changed that idea. There are indeed quite a few examples of extreme temperatures even here on Earth where life has been found to thrive enduring the most challenging of environments, most notably, from Antarctica, where the temperatures can get to -94° F, to extremely hot hydrothermal vents that lie underneath the oceans which roil at 235° F. So life may very well persist in Gliese 581d after all. One thing remains however is that although it seems that Gliese 581d is habitable but experts believe that it could have kept some atmospheric hydrogen, like in Uranus and Neptune, or the possibility of the fierce solar-wind from its star during its infancy which could even have torn its atmosphere away entirely. Nonetheless, it is believed to be a crucial discovery because for the first time climate models have been applied to prove that the planet is habitable. It is now believed that the diversity of planetary climates is far wider and complex than it is understood to be. Many ponder over the fact that such findings will

usher in the idea that life-supporting planets not necessarily need to be like what we have here on Earth.

There is another candidate within the same Gliese 581 star system. And that particular planet is called Gliese 581g which is an extra-solar planet, orbiting this red dwarf star that is approximately 20.5 light years away from Earth in the constellation of Libra. Being the 6^{th} planet discovered in the Gliese 581 planetary system and the 4^{th} one in order from the star, the Gliese 581g is strongly believed to be located in the habitable zone as well. And it is important to mention here that, similar to our solar system, all the six planets around the star Gliese 581 have nearly circular orbits. Few years back, this crucial cosmic discovery was made using radial velocity measurements combining 11 years of data from the HIRES instrument of the Keck 1 telescope at the W. M. Keck Observatory in Hawaii and the HARPS instrument of European Space Observatory's 3.6m telescope at La Silla Observatory, Chile. At the time of the discovery, scientists deemed that of around 500 planets that have been found outside Earth s solar system, this one was the very first to be considered habitable. Gliese 581g is believed to have a mass of 3.1 to 4.3 times that of the Earth and radius of 1.3 to 2.0 times that of the Earth and its mass indicates that it s probably rocky with a definite surface and houses enough gravity to hold an atmosphere (one of the crucial jobs of gravity is to hold an atmosphere in a planet). Astronomers also believe that this planet is the first Goldilocks planets ever found and the best extra-solar planet candidate with the potential for harboring life found to date.

One of the most interesting aspects of this planet is that, Gliese 581g has an orbital period of just 37 days and the planet is tidally locked to the star Gliese 581. This means, one side of the planet is always facing the star and basking in continuous daylight while the other side facing away from the star is in constant darkness, just like our very own moon. And scientist suspect that the most habitable zone on the planet s surface would be along the line between shadow and light (now known as the terminator), where surface temperatures deceases

towards the dark side and increases towards the illuminated one. But this does not mean that the planet might be one of an advanced civilization with much superior technology and intelligent ways of life. Experts believe that even a single-cell bacteria or any life-form equivalent of shower mold is enough to revolutionize our perceptions about the uniqueness of life on Earth in the midst of this entire Universe.

Gliese 581g is actually not that far away from Earth. But given the immensity of our Universe, it would take tens of thousands of years to get to the planet using the conventional rocket technologies. And if traveled at a tenth of the speed of light, it will take 200 years to reach there. But there is no rush though. Gliese 581g might not be the only candidate with the possibility of extra-terrestrial life-forms. The findings of Gliese 581g strongly suggest that there may be billions of other habitable planets like our Earth in this Universe. According to one scientific examination, there are as many as 1 in 5 to 10 stars in the Universe that have planets which are Earth-sized and reside in the habitable zone. And with an estimated 200 billion stars in the galaxy, this truly means that around 40 billion planets could have all the potential to harbor extra-terrestrial life-forms!

Cosmic Criteria for Life

Our understanding towards the star system Gliese 581 and her possible life supporting planets brings a crucial aspect in the context of our search for alien life-forms that require a firm comprehension on what matters are truly required at the first place for an extra-solar planet to house any life-forms, possibly intelligent kind. Hence, we need to understand the aspects of planetary habitability, i.e., the factors behind a planet s potential to develop and sustain life. It must be understood that in order to host any kind of life-form, a planet must meet all the geophysical, geochemical, and astrophysical criteria which National Aeronautics and Space Administration (NASA) defines as extended regions of liquid water, conditions favorable for the assembly of complex organic molecules, and energy sources to sustain

metabolism . This study of the planetary habitability, which falls under the realm of astrobiology, focuses on the planet s bulk composition, orbital properties, ability to sustain an atmosphere, potential Earth-like chemistry interactions as well as the characteristics of its Sun, like mass and luminosity, stable variability, and the rate of high metallicity (in astronomy and physical cosmology the metallicity of an object is the proportion of its matter made up of chemical elements other than hydrogen and helium, chief elements that make up a star).

It is believed that the scientific exploration towards the extra-solar planets began back in early 1990s, followed by a growing enthusiasm on that respective issue. In 2013, it was reported that based on Kepler space mission data, that there could be, as we already understand it, as many as 40 billion Earth-sized planets orbiting in the habitable zones of sun-like stars and red dwarf stars within the Milky Way galaxy alone. And 11 billion of these estimated planets may be orbiting sun-like stars.

And the nearest such planet may be just 12 light-years away!

Kepler Kaleidoscopes

Few words are in order regarding the Kepler spacecraft. It all began on March 6th, 2009, when NASA launched the Kepler Spacecraft from the Cape Canaveral Air Force Station, Florida; the mission objective is to discover Earth like planets orbiting other stars. This 600 million dollar project is not just a scientific mission but a historic one as well because for the next 3.5 years Kepler was to observe over 100,000 stars around Cygnus and Lyra constellations of the Milky Way and identify the true Earth analogs, that is Earth-sized planets orbiting stars like that of our good old Sun at distances where surface water and hence life could certainly exist. This mission is of great significance for the human race because according to William Borucki's words, the mission's principle science investigator, Even if we find no planet like Earth that by itself would be profound. It would indicate that we are probably alone in the galaxy .

Armed with the largest camera ever launched into space, a 95 mega pixel array of charge-coupled devices (or CCD's, like the ones in ordinary digital cameras) with a 12 degree diameter Field Of View, Kepler is the world s first mission with the ability to find true habitable zones in the space as it is specially designed to survey the extended solar neighborhood to detect and characterize hundreds of terrestrials and larger planets in or near the habitable zone which will broaden the understanding of planetary formation, the frequency of formation, the structure of individual planetary systems and the generic characteristics of stars with terrestrial planets. The first planets that are expected to be exposed to Kepler s radar are portly hot Jupiter s which are basically gas giants (a large, massive, low-density planet composed primarily of hydrogen, helium, methane, and ammonia in either gaseous or liquid state), that circle close and fast around their stars followed by Neptune size planets and then rocky ones like that of Earth. As the mission progresses Kepler will drift farther and farther behind Earth in its orbit around the sun in search for true Earth analogs, planets with surface water and possibly life!

The chance of the Kepler Mission to detect Earth-like planets is much higher than the Hubble Space Telescope because in contrast to the latter one, Kepler has the ability to observe over 100,000 stars simultaneously while measuring variations in their brightness every thirty minutes. Besides, there is a strong probability that if 100% of stars studied by Kepler out there had the exact same diameter as the Sun and each had one Earth-like terrestrial planet in an orbit identical to that of the Earth, then Kepler would find about 465 of them. Scientists also expect that since Kepler, which is an Earth-trailing solar orbit, is pointing in the direction of the Solar System s motion around the centre of the galaxy, the stars that are going to be observed by Kepler are roughly the same distance from the galaxy centre as the solar system. This fact is very crucial because it will usher the better understanding on whether the position in the galaxy is related to habitability which is suggested by the Rare Earth Hypothesis, a theory

that states that Earth-like life is rare in the Universe while microbial life is common.

Somebody once said the story of the universe is the story of each of us and Kepler's active effort to determine if any other planet harbors life, perhaps with civilizations more advanced than ours will only help us understanding ourselves better. Whatever the findings may be of Kepler it will definitely make way for future journeys that will usher betterment for mankind and aid us in realizing how insignificant yet terrifically crucial our existence is in the whole wide universe.

The Star Factor

Now getting back to our main topic of understanding the key prerequisites of planetary habitability in terms of its hosting alien life-forms. It must be understood that a major portion of what determines whether life would exist or not at the first place, depends on the stars. So let us understand some quick basic facts about stars themselves. It is understood that stars of all kinds are, at most basic, born from a collapsing giant of cloud and dust called molecular cloud or nebulae (will be explained shortly) and then gradually begin to collapse under the influence of its own gravity which is triggered by a collision with another molecular cloud or the shockwave from a nearby supernova (a star that suddenly increases greatly in brightness because of a catastrophic explosion that ejects most of its mass) or even from a collision of galaxies.

Now what is a nebula? By simple definition a nebula is an interstellar cloud of dust, hydrogen, plasma, helium and other ionized gases (the process of conversion of atom, molecule or other substances into an ion or ions, typically by removing one or more electrons). This gathering of gas and dust that make up the nebula is collectively known as the interstellar medium or ISM. If we trace the history of the name nebula, we find that the Latin word comes from ancient Rome which linguistically means a cloud, or a mist or a vapor and in the ancient times when the Romans looked up in the sky and categorized

all the faint, less glowing stars as nebulae, the plural linguistic form of the cosmic object.

Experts say that, in the ancient times, nebula was actually a general name given for any extended astronomical object including galaxies beyond the Milky Way, for example Andromeda Galaxy was called Andromeda Nebula at once upon a time, not any more though since Edwin Hubble discovered the true nature of galaxies; however, the name got stuck and continue to be applied to name the visibly and thinly spread celestial cloud of interstellar gas and dust. Research has found that some nebulae are basically the remnants of a supernova explosion while others are gravity-induced condensation of the gases which at some point in future may form new stars.

It is understood that there are few kinds and types of nebulae. Let s start off with diffuse nebulae as most nebulae can be described as diffuse ones. Researches have found out that diffuse nebulae have irregular forms and often large angular dimensions and they are extended and contain no well-defined boundaries. Also with respect to the quality of their light, there are two types of diffuse nebulae, emission and reflection. It is understood that as the ionized atoms capture other electrons, the nebulae emit light that may differ from that of the stimulating stars and these particular nebulae are defined as emission nebulae. It was found out that emission nebulae emit spectral line (an isolated bright or dark line in a spectrum produced by emission or absorption of light of a single wavelength) radiation from ionized gas, most notably hydrogen and reflection nebulae were found not to emit significant amount of visible light; however, usually located close to stars and reflect a good amount of light from them. To put it in simple words, an emission nebula is a nebula that glows and its reddish light are produced when electrons and protons combine, forming hydrogen atoms. Reflection nebulae are, on the other hand, essentially made of dust, which is illuminated by foreground stars that gives them their typical blue color and reflection nebulae do not themselves emit any significant amount of visible light but rather located close to stars and reflect light off from them. A reflection nebula always shows the characteristic spectrum of the star illuminating it but it is understood

that its actual color is somewhat bluer than that of the star making it visible. And the key reason for this is that some of the red light passes through and is not reflected, causing the reflected light to be a little bluer than the star itself. In other words, a reflection nebula is a nebula that glows as the dust in it reflects the light of nearby stars.

Also planetary nebulae which are emission nebulae with spectra similar to those of emission nebulae found in star formation regions, form from the gaseous shells that are ejected from low-mass asymptotic giant branch stars when they transform into white dwarfs. In simpler words, planetary nebulae consist of an extremely hot star surrounded by a tenuous shell of ionized gas and have absolutely nothing to do with planets. Dark nebulae are clouds of gas and dust that are sufficiently dense to obscure the stars behind them and have no stars near enough to light them effectively. Their faint illumination by the general star fields can be detected only by measurements of high precision and dark nebulae make their presence known optically by obscuring whatever lies behind them. And lastly, a supernovae remnant, a kind of diffuse nebula, is formed from the expanding shell of gas from the grand supernova itself. Some of the nebulae that intrigued mankind include Horse head, Crab, Orion, Eagle, Helix, Cat s Eye, Ant, Pelican, Lagoon, Tarantula, Ring, Hourglass, Eskimo and quite a few others.

Now getting back to the main point of the topic which is the influence of stars on the creation aspects of life; we were at a stage when clouds from the remnant massive cosmic objects are roaming the space but as the time progresses by millions to billions of years, these clouds contract, break apart and eventually an individual portion will condense into a hot and dense sphere known as a proto-star. And when the proto-star becomes hot enough to commence the fusion of hydrogen into helium, a new star is born. And hence, begins journey of one of the most spectacular creations of the cosmos. The proto-star continues to condense and ultimately reaches a critical mass and nuclear fusion begins which commences the main sequence phase of the star which lasts for about few hundred thousand years. The bigger

the star is, the shorter the time span of the main sequence stars. Red dwarf, which is a stage during the main sequence period, is a small, dim star that fuses hydrogen at a slow rate and medium-sized yellow dwarfs, such as our Sun will be in the main sequence stage for several billion years. It is important to mention here that our Sun is about half away through its main sequence evolution. Ultimately a star will ran out of its hydrogen fuel and begin its fusion of helium and other elements, at which point the star will leave its main sequence phase. And as it takes place, the red dwarf stars will use up all their hydrogen and collapse directly into a white dwarf and mid-size stars like that of our Sun will continue to expand and evolve into a red giant star, a large, old, luminous star that has a relatively low surface temperature and a diameter relatively large to that of the sun. This red giant stage takes place because when the star runs out of hydrogen at its core, the core collapses and the star begin fusing helium while hydrogen fusion transferred into the outer layers of the star. And this very fact causes star to swell into many times to its original size and gradually it cools down as the heat is distributed over a larger area. And in this way more massive stars grow into super-giants which are the largest of stars in our Universe.

But this growing process is not forever. This phase will continue until the star exhausts its remaining fuel at which point the pressure of the nuclear reaction isn t strong enough to equalize the force of gravity and eventually the star will collapse. Medium sized stars like our sun will blow away their outer atmosphere to form a planetary nebula; however, their core will collapse into a white dwarf which will eventually cool into a black dwarf. But in the case with massive stars, the same collapse procedure will trigger a violent explosion called supernova. This takes place because of the fact that when the massive star begin to fuse irons within itself, the process absorbs energy and causes the core to collapse violently while the outer layers are ejected with incredibly massive force. Once that takes place and if the remaining mass of the star is about 1.4 times that of our sun, the core becomes unable to support itself and eventually collapse to become a

neutron star. The matter inside the star at that stage is compressed so tightly that its atoms are compacted into a dense shell of neutrons. And if the remaining mass of the star is more than about three times that of the Sun, it will collapse so completely that it will literally disappear from the face of the universe. And what will be left behind, is an intensely gravity powered nothingness called black hole, that is absolute last stage of the lifecycle of a cosmic star.

How a star collapses into black hole, this magnificent cosmic journey could further be understood by a historic story. It all began in the year 1928, when an Indian graduate student named Subramanian Chandrasekhar who went to Cambridge University to study astronomy, stumbled upon a revolutionary idea about stars. The young Indian scholar thought that it would be intriguing to know how big a star could get while still supporting itself against its very own gravity even after it has used up all of its fuel that illuminated itself at the first place. It is understood that, in its lifespan, when a star eventually becomes very small, the matter particles in it becomes very close to each other. And based on Pauli Exclusion Principle, these particles have very different velocities which make them move away from each other which, in effect, make the appearance of the star as if it is expanding. And thus, a star, at that stage, maintains a steady radius given the balance that exists between the attractions of gravity and the repulsion that arises from that very exclusion principle. But Chandrasekhar very soon realized that there's got to be a limit to the process of repulsion that the exclusion principle provides.

It is understood that according to the law of Theory of Relativity, given nothing could travel faster than the speed of light, there is a limit to the maximum differences in the velocities of the matter particles in the star. And as per this understanding, when the star is sufficiently dense, the repulsion rate triggered by the exclusion principle would be less than the attraction of the gravity. And the brilliant Tamil scientist calculated that a cold star of more than one and half times the mass of our very own Sun would not be able to support itself against its own gravity. And this mass is now known as the Chandrasekhar limit.

And here is how it goes. Since most stars in the Cosmos end their lives as white dwarfs (WD) and the size of such WD depend on its mass. And unlike other stars, WD shrinks in sizes as their mass increases and a WD as massive as our Sun will have a diameter like that of the Earth. And with greater mass, WD gets smaller and smaller while the rate of WD density increases progressively side by side. And at 1.4 solar masses (more than one and half times the mass of our very own Sun, as previously discussed) the WD come to its smallest possible diameter limit and this critical limit is called Chandrasekhar Limit. At this stage densities of the WD would weight hundreds of tons per cubic inch where electrons drive into protons in the nuclei of atoms which effectively produce neutrons and eventually a neutron star is formed out of the whole process.

Star classification and stellar evolution is an important factor for the emergence of life. Some stellar types have a relatively short duration, making it unlikely candidate to support life, especially when it takes an immensely long period needed for one to evolve into intelligent forms. While some stars will become neutron stars or black holes too soon for life to evolve at all. Others will continue to appear to our telescopes to be visible stars. But at a closer glimpse, that image might turn out to be millions to billions of years old and her light only made it to Earth recently which is nothing but a reminiscent of her past as she is gone and all done for by some massive supernovae explosion where outer region of a star gets blown off in a tremendous bang taking most of her surroundings (planets in her own solar system) with her for good.

Now there are billions of stars out there in the Universe. Which ones are suitable enough for the study concerning the search for extra-terrestrial civilization? With all of these stars shining bright in the heavens, how is it possible to narrow down the field to those stars that are exact similar to our own Sun that is stars might support a planet with intelligent life on it? And here is the answer; there is indeed a way to detect such promising stars. Astronomers are able to classify stars in accordance to such characteristics such as mass, luminosity and surface temperature. This system of classification is better understood through a series of English letters, where each letter represents the true

condition of the star for the better understanding of whether that particular star could favor any planet to host life of any kind or form. The letters are: O, B, A, F, G, K, M, in astronomy these series of letters are also known as Oh, Be A Fine Girl, Kiss Me , a somewhat romantic take on an effort to remember the letters by applying the capital letters of the sentence as abbreviation. Now, these letters, O, B, A, F, G, K, M represents the temperature of the star where the order here has been established in sequence of the hotter-most to decreasing temperature, from left to right order. This means that O here represents the hottest star, B is the next hottest and eventually M is the most cool one of all. Our own Sun is a G star, a main sequence star which means that it has been around long enough to help develop life in planets surrounding it. So, the best star candidate to look for that might influence the development of life is a G star, like our own Sun.

Stars are classified by their spectra, distinguished by the strength of the spectral lines of different elements, beginning with hydrogen, the most basic element that makes up a star. If we explain, one by one, the O, B, A, F, G, K, M spectral classification system, the following is what we get. O stars are massive, very luminous and blue-white, indicating extremely high temperatures (about 20,000 K and up). Type O spectra show lines of ionized helium, nitrogen and oxygen. Good examples are Naos and Iota Orionis A; none are known to be suitable enough to host life in their planetary system. After that we have, B stars, which are also massive, luminous, blue-white and hot (up to around 20,000 K). Their spectra display strong helium lines. This is followed by A type stars that are luminous, white, with temperatures around 10,000 K. Although Helium lines are absent from type A spectra, but hydrogen is strongest in this type.

F stars are the next in line which are basically yellow-white, indicating temperatures around 7,000 K. Their spectra exhibit weaker hydrogen and strong calcium. One well-known example is Canopus, the brightest star in the southern constellation of Carina, and the second brightest star in the night-time sky, after Sirius. G stars, are next in line which are of course the most promising ones to host life as evidently shown by our own Sun. These particular stars are yellow with

temperatures around 5,000 to 6,000 K and hydrogen lines are weaker again; many metals are present. In addition to the sun, another example of G type star is Alpha Centauri A. Second to last is the K stars which are orange, around 4,000 to 4,700 K, and display faint hydrogen lines, strong metallic lines, and some hydrocarbon molecular bands in their spectra. And lastly we have M stars that include the red dwarfs and red giants. They are only very weakly luminous, red; with temperatures around 2,500 to 3,000 K and their spectra are characterized by many strong metallic lines and also wide titanium oxide bands.

When we consider star factor in planet habitability issue, it is important to exclude any first-generation star systems. Because these are the stars which are condensed from, more or less, primordial matter from the big bang and as a result, there would be essentially no carbon, oxygen, metals, etc. which presumably prevent the development of complex life-forms, let alone intelligent ones. Multiple star systems present potential problems for the development of intelligent life as well. And this is because when two stars are close enough and there is a sufficient difference in mass, the larger can draw matter from the smaller star. Thus the trail of accreting matter and the radiation released in the process could make the happening of complex life very unlikely. Depending on the proximity of the masses, gravitational forces could cause peculiarities in planetary orbit around one star or could cause a more complex orbit involving both stars. Such strange orbit or unpredictable gravitational effects could cause difficulties for the emergence of life in planets surround the star/s.

Another consideration is the proximity of stars to the galactic center (not in multiple systems), for instance closer towards the galactic core, may make regions of the galaxy too highly radiated or otherwise too hostile for life. Another factor is that, some star systems form in such a way that asteroid impacts continue to be a greater and more frequent problem for life to grow in celestial bodies that surround the star. This could also mean that too many mass extinction events for intelligent life to develop, mature and progress. If we can identify which stellar systems are of a type that tends to have too many asteroids that are likely to impact on the surrounding planets, we could categorize those

solar systems as improbable for intelligent life and move on to other locales to investigate for other star systems for the grand quest.

The Liquid Factor

One significantly decisive factor that influence in a great deal on the possibility that life would exist on a planet or not, is the location of the planet in what was discussed earlier as the Habitable Zone of the Universe. That is, as previously explained, a region of space surrounding a star in which a planet could maintain liquid water on its surface. Provided that we are still focused on the water-dependent exo-biology theory, that is, the presence of liquid water is the most crucial ingredient for life, this habitable zone which is also known as the Goldilocks Zone is the determinant factor where a planet or several planets with enough atmospheric pressure are able to maintain liquid water on their surface without the water neither being completely vaporized or frozen, and thus sustain life eventually. Two key factors greatly influence when a stable habitable zone is being considered; first one is the range of a habitable zone which should not vary greatly over time. Considering the fact that all stars increase in luminosity as they age, and a given habitable zone thus migrates outwards, however if this happens too quickly in cosmic sense of the time, planets may only have a brief window inside the habitable zone and a correspondingly smaller chance of developing life, let alone see it through to its maturity. This means that a right amount of time factor is crucial for the planetary life to develop and evolve even if it is within the habitable zone boundary of that particular solar system.

Secondly, even though it is understood that in a solar system, usually the inner planets are terrestrial, and the outer ones are gas giants, but recent discoveries of extra-solar planets suggest that this arrangement may not be at all common throughout the Universe. Therefore it is perhaps for the best that no large-mass body such as a gas giant should be present in or relatively close to the habitable zones which might disrupt the formation of Earth-like bodies that have the potentials to develop extra-terrestrial life-forms.

The Light Factor

The luminosity of the stars is also another crucial factor for the development of life. It is understood that changes in luminosity are common to all stars, but the severity of such fluctuations is one aspect that require considerable attention. Most stars are relatively stable, but significant minorities of variable stars often undergo sudden and intense increases in luminosity and consequently in the amount of energy radiated toward the other celestial bodies roaming in and around their orbital path. These stars are considered to be poor candidates for hosting life-bearing planets, as their unpredictability and changes in energy output are likely to impact very negatively on organisms, chiefly because living things adapted to a specific temperature range will not survive too great a temperature variation. Further, a shift towards high in luminosity is generally accompanied by massive doses of gamma ray and X-ray radiations which might prove to be extremely lethal to the formation of any life. Atmospheres do mitigate to such effects, but in the long run such atmosphere might not be retained by planets orbiting such stars, because the high-frequency energy buffeting these planets would continually strip them of their protective covering and cause the planet to become inhospitable to sustain life of any kind or form.

It is also commonly known that the bulk of material in any star is hydrogen and helium. But there can be a great variation in the amount of heavier elements like metals that stars contain. Research found out that a smaller amount of metal makes the formation of planets much less likely. And any planets that did form around a metal-poor star would probably be low in mass, and thus unfavorable for the development of extra-terrestrial life-forms.

The Size Factor

The mass of a planet is also a pretty determinant factor behind the possibility of hosting alien life-forms. In physics, mass is a property of a physical body which determines the body's resistance to being

accelerated by a force and the strength of its mutual gravitational attraction with other bodies. There are particularly two reasons why low-mass planets are poor candidates for life. First, their lesser gravity makes atmosphere retention (atmosphere s ability to absorb) difficult and the molecules in the atmosphere are more likely to reach escape velocity and be lost in space when buffeted by solar wind or stirred by collision. And as a result, planets without a thick atmosphere lack the matter necessary for primal biochemistry and that could lead to the impossibility for the development and evolution of life. Secondly, smaller planets have smaller diameters and thus higher surface-to-volume ratios than their larger counterparts. Such bodies tend to lose the energy left over from their formation quickly and end up geologically dead, lacking the volcanoes, earthquakes and tectonic activity which usually supply the planet s surface with life-sustaining materials and the atmosphere with temperature moderators like carbon dioxide that could influence on the possibility of life.

Planet size is indeed an issue. Let s take Mars for example in this regard. Although Mars may have an orbit that could work for complex life, its mass does not allow it to hold onto as much atmosphere as the Earth. It is understood that the amount and composition of a planet s atmosphere will affect how much solar heat is retained and how much solar radiation is filtered out. And it has been found out that, Mars has come to have too little atmosphere to maintain a temperature suitable for life. Planet size and density will also determine the gravity, and eventually the life on the planet must be able to function in.

It also must be mentioned that when we are talking about Low mass and the possibility of a extra-solar planet to house life, the Earth herself is low mass when compared to the Solar System s gas giants, but it is the largest by diameter and mass, and the densest of all terrestrial bodies. But that didn t hamper Earth s hosting life because all other factors were in favor of happening that miraculous event. Finally, another point to add to the fact that a larger planet is likely to have a large iron core and this eventually allows for a magnetic field to

protect the planet from stellar wind and cosmic radiation, which otherwise would tend to strip away planetary atmosphere and likely to bombard living things with ionized particles. And that surely is not a preferable scenario for nourishing any life-forms at the first place.

The Flight-Path Factor

The orbital and rotational characteristic of a planet is also a critical consideration on planetary habitability. It is understood that the orbital eccentricity is the difference between a planet s farthest and closest approach to its parent star divided by the sum of said distances, and the greater the eccentricity the greater the temperature fluctuation on a planet's surface. Even though they are adaptive, living organisms can stand only so much variation, particularly if the fluctuations overlap both the freezing point and boiling point of the planet's main biotic solvent, like the water we have on Earth. For example, if Earth's oceans were alternately boiling and freezing solid, life as we know it, perhaps would not have evolved here.

A planet's movement around its rotational axis must also meet certain criteria if life is to have the opportunity to evolve there. A first assumption is that the planet should have moderate seasons. If there is little or no axial tilt relative to the perpendicular of the ecliptic, seasons will not occur. On the other hand, if a planet is radically tilted, meanwhile, seasons will be extreme which will make it more difficult for a biosphere to achieve homeostasis (Homeostasis is the property of a system in which variables are regulated so that internal conditions remain stable and relatively constant. It is a process that maintains the stability of the human body's internal environment in response to changes in external conditions).

Life in Extremes

Even though life as we know (life based on DNA or RNA) requires liquid water, organic compounds and a source of energy but the discovery of life in extreme conditions has also complicated the definitions life s habitability itself on a planet. For example, a planet

that might otherwise be unable to support an atmosphere given the solar conditions in its vicinity might just be able to do so within a deep shadowed rift or volcanic cave. Earth environments that are unable to support life are still greatly informative to astro-biologists in defining the limits of what organisms can endure. The heart of the Atacama Desert, in South America, is generally considered the driest place on Earth, appears unable to support life, but it has been subject to study by NASA for one particular reason, and that is whether life somehow could persist in the harshest of conditions. Extremophiles (an extremophile is an organism that thrives in physically or geo-chemically extreme conditions that are detrimental to most life on Earth) on Earth live at a very wide range of temperatures (from -20C to +122C), at high levels of salinity and alkalinity (such as in Mono Lake in California), and even in areas of high radiation such as the cooling systems of nuclear reactors. In Saturn s moon Titan, where the temperatures are far below the freezing point of water, scientists believe that even in this bitter cold, hydrocarbons like methane and ethane are liquid, and might conceivably form the basis for carbon-based life very different from that on Earth. So, all these have increased the range of possibilities that life may exist in the harshest of conditions elsewhere in the Universe as well.

The Alien Planets...so far

As it is understood that extra-terrestrial liquid water is a prerequisite for any extra-terrestrial life-forms, let us look at some extra-solar planets that are believed to candidates to host liquid water one way or another.

For starter we have COROT-9b, this is an exo-planet, a gas giant to be precise, orbiting the star COROT-9, approximately 1500 light years away from Earth, located in the constellation Serpens. With an orbital period of 95 days, the transit of this planet lasts 8 hours and the planet is at a distance from its star where a strong increase in albedo takes place as the temperature decreases and it is because of the condensation of reflective water clouds in the atmosphere. Although it

is mostly made of hydrogen and helium it may contain up to 20 Earth masses of other elements, including water, which interests us greatly, and rock at high temperatures and pressures.

Next candidate is an asteroid around GD 61 which is a white dwarf star, with a planetary system located 150 light-years from Earth in the constellation Perseus. This asteroid has given the first direct evidence of a water-rich rocky planetary body outside our Solar System. The asteroid is believed to be part of the debris from what might once have been a rocky planet with either ice or oceans. Back in 2013, a circum-stellar disk that resulted from the destruction of a water-rich asteroid was detected in close orbit around GD 61, which makes this the first detection of solid or liquid water on an extra-solar body. This asteroid would originally have been 26% water by mass, close to the water content of Ceres (Ceres is the largest object in the asteroid belt, which lies between the orbits of Mars and Jupiter. It is a ball of rock and ice 950 km in diameter, containing a third of the mass of the asteroid belt). This evidence suggests that a planet, with a rocky surface similar to Earth's, may have existed in the past, with the asteroid thus being an artifact from this period, now possibly part of a debris field from the hypothetical planet's breakup. It is believed that such a planet would have had a rocky surface and water, two key ingredients for life.

Gliese 581 c, another planet from the famed Gliese 581 star system, is a planet five times the size of the Earth, was originally reported to be the right distance from its sun for liquid water to exist on the planet's surface. But since it does not transit its sun, there is no way to know for sure if there is any water there.

Gliese 667 Cc was originally described as one of two super-Earth planets around Gliese 667 C, a dim red star that is part of a triple star system that is sited 22 light-years away, in the constellation Scorpius. Studies have found out that Gliese 667 Cc, in a tight 28-day orbit of a dim red star, must receive 90% of the light that Earth receives, but most of its incoming light is in the infrared, a higher percentage of this incoming energy should be absorbed by the planet. The planet, sizing

3.9 times more massive than our own planet, is expected to absorb about the same amount of energy from its star that Earth absorbs from the Sun, which would allow surface temperatures similar to that of Earth and perhaps to a greater extent, liquid water.

Next one is called GJ 1214 b which is an exo-planet that orbits the star GJ 1214. GJ 1214 b is believed to be three times the size of Earth and about 6.5 times as massive. Its low density indicated that it is likely a mix of rock and water, and some recent observations of the Hubble telescope now seem to confirm that a large fraction of its mass is water.

HD 28185 b was the first exo-planet to be detected in the habitable zone but is believed to be a gas giant, with no solid surface. Some scientists have argued that it could have moons large and stable enough to have oceans. HD 85512 b, an exo-planet orbiting Gliese 370, a star approximately 36 light-years from Earth in the constellation of Vela, on the other hand, is planet that is larger than Earth, but small enough to be probably a rocky world. HD 85512b was announced in 2011 as part of a treasure trove of 50 planets discovered by the High Accuracy Radial velocity Planet Searcher instrument, or HARPS, in Chile. The planet is located right on the borders of its star's habitable zone and might have liquid water, and is a potential candidate for a life-supporting world.

Another strong contender for extra-terrestrial liquid water is Kepler-22b, a planet 2.4 times the size of Earth, with an estimated temperature of 22 °C. It was one of the strong candidates found by the Kepler telescope as potentially habitable with great possibility of nourishing liquid water. While Kepler-22b is bigger than Earth, it circles a star that is quite close in size and temperature to Earth's sun. Kepler-22b is 2.4 times Earth's size and located in the star system that is about 600 light-years away from Earth's sun, in the constellation Cygnus.

Comets may also contain large proportions of water ice, but are generally thought to be completely frozen due to their small size and

large distance from the Sun. However, studies on dust collected from comet Wild-2 show evidence for liquid water inside the comet at some point in the past. Comet (an icy small Solar System body that, when passing close to the Sun, heats up and begins to outgas, displaying a visible atmosphere or coma, and sometimes also a tail) is pretty interesting cosmic factor as many scientists believe that comets bombarding the young Earth about 4 billion years ago brought the vast quantities of water that now fill the Earth's oceans, or at least a significant portion of it. The detection of organic molecules in considerable quantities in comets has led some to speculate that comets or meteorites (a meteorite is a solid piece of debris, from such sources as asteroids or comets that originates in outer space and survives its impact with the Earth's surface) may have brought the precursors of life or even life itself to Earth!

The Kepler-62 is also a promising star system that has five planets, two of which are believed to be at the right distance from the star to have liquid water and potentiality to sustain life. And Kepler-62e orbits on the inner edge of the habitable zone and is roughly 60 percent larger than Earth. Both are assumed to be rocky planets, but since the star is 1200 light-years away located in the constellation of Lyra, more research are in order. But scientists believe that Kepler-62e is one of five planets known to orbit the star Kepler-62 and the planet and its potentially habitable neighbor, Kepler-62f, are water worlds , warm places mostly or completely covered by liquid water. Kepler-62f is only 40% larger than Earth, making it the exo-planet closest to the size of our planet known in the habitable zone of another star. Next in line is Kepler-69c which is a large rocky planet, sizing 70% more massive than the Earth and one of two planets known to be orbiting the star Kepler 69, which is similar to our sun. It is believed that the planet is located in the star's habitable zone.

Another planet that scientists are pretty excited about is called Kepler-186f, discovered by the Kepler space telescope and the planet circles a dim red dwarf star about 490 light-years from Earth. For the first time,

scientists believe that they have discovered an Earth-size alien planet in the habitable zone of its host star, an Earth cousin that just might have liquid water on its surface and the right planetary habitability conditions for life. It is understood that while the host star is dimmer than Earth's sun and the planet is slightly bigger than Earth, the positioning of the alien world coupled with its size suggests that Kepler-186f could have water on its surface. Scientists think that Kepler-186f, the outermost of five planets found to be orbiting the star Kepler-186, orbits at a distance of 32.5 million miles (52.4 million kilometers) and possibly located within the habitable zone for a red dwarf. This newly discovered planet (identified in 2014) measures about 1.1 Earth radii (plural form of radius, which is a straight line from the centre to the circumference of a circle or sphere), making it slightly larger than Earth, but researchers still think this alien world may be rocky like Earth. However scientists still aren't sure what Kepler-186f's atmosphere is made of, a key to the absolute understanding of whether the planet is hospitable to life or not.

Another Kepler find, Kepler-283c is about 1.8 times bigger than Earth and completes one orbit in every 93 days. The planet is one of two worlds known to circle the star Kepler-283, which is just over half as wide as Earth's sun. The other planet in the system, Kepler-283b, lies much closer to the star and is thus probably too hot to host life. But Kepler-283c on the other hand is a strong candidate to host liquid water on the surface and thus life.

Another planet dubbed as Super-Earth (Rocky planets that are almost as big as Uranus seem far more common than anyone suspected. In our Solar System, planets fall into two types. First, there are the rocky planets like Earth, Mars, and Venus, which are similar in size and support gaseous atmospheres) is HD 40307g which orbits comfortably inside the habitable zone of its parent star HD 40307. And it lies about 42 light-years away from Earth in the constellation Pictor. It is so close by that many believe future telescopes may be able to peer at its surface. It orbits its parent star about 56 million miles (90

million kilometers) away, which is just over half of the Earth-sun distance of 93 million miles (150 million kilometers) and a possible candidate for hosting extra-terrestrial life-forms.

The next candidate was discovered in December, 2012, Tau Ceti e is found just 11.9 light-years from Earth and believed to be a super-Earth , at least 4.3 times as massive as Earth. Depending on its atmosphere, scientists speculate that Tau Ceti e could be either a mildly hot planet suitable for simple life or a scorching world like Venus. Tau Ceti f is a super-Earth candidate like its sibling, Tau Ceti e, but it orbits close to the outer edge of Tau Ceti's habitable zone. However, Tau Ceti f is at least 6.6 times as massive as Earth and could be suitable for life that is if its atmosphere traps significant amounts of heat.

NASA, as an effort to its own quest for life on other planets, in 2013 with the aid of Hubble Space Telescope detected water in the atmospheres of five planets beyond our solar system. The five exo-planets with hints of water are all scorching-hot, Jupiter-size worlds that are unlikely to host life as we know it. But finding water in their atmospheres still marks a step forward in the search for distant planets that may be capable of supporting alien life. The two research teams that were involved in this study, used Hubble's Wide Field Camera 3 to analyze starlight passing through the atmospheres of the five hot Jupiter planets (A hot Jupiter is an extra-solar planet that orbits its star very close in, very much to the contrast with our Jupiter, our Jupiter orbits at five astronomical units from the Sun), which are known as WASP-17b, HD209458b, WASP-12b, WASP-19b and XO-1b. The atmospheres of all five planets showed signs of water, with the strongest signatures found in the air of WASP-17b and HD209458b.

These are just some of the candidates around some distant stars that many scientists believe could host extra-terrestrial life-forms. But what about the stars themselves that are likely to be favorable to host life for the planets in their own solar system? Such five stars that scientists have discovered so far are, beta CVn, a sun-like star about 26 light

years away in the constellation Canes Venatici, HD 10307, a solar analogue about 42 light years away which has almost the same mass, temperature and metallicity of the Sun. Another candidate is HD 211415, about half the metal content of Sun and a bit cooler, this star is just a little farther away than HD 10307. And the remaining two are 18 Sco, a popular target for proposed planet searches and this star, in the constellation Scorpio, is almost an identical twin to the Sun. And lastly, 51 Pegasus, discovered in 1995 by Swiss astronomers who reported that they had detected the first planet beyond our solar system in orbit around 51 Pegasus that may have the possibility of hosting extra-terrestrial life.

Anybody Out There?

All these knowledge and discoveries of possible new Earth-like planets with potential alien life-forms calls for a great deal of research and technological innovations and not to mention, a great deal of devotion to science. We learnt a lot and still learning about the ways of the Universe, all that is aiding in our quest to see if we are truly alone in this vast cosmic arena. For years scientific minds have tried to find a way to make contact with possible beings from other planets. As our primary step towards understanding ways of establishing contact with extra-terrestrial life-forms, especially intelligent ones, let us first comprehend what are the existing methods of communicating with such possible other planetary beings. To be simple, Communication with extraterrestrial intelligence also known as CETI (not to be confused with any organization that might share the same abbreviation) is a branch of the search process for extraterrestrial intelligence that focuses on composing and deciphering messages that could theoretically be understood by another civilization that might be technologically advanced. Although CETI research has focused on four broad areas which include mathematical languages, pictorial systems such as the Arecibo message, algorithmic communication systems (ACETI) and exclusively computer based approaches.

But the beginning of the process of establishing contact with beings from other planets wasn t always this sophisticated.

The Contact: A History

Johann Carl Friedrich Gauss, the 18th century German mathematician, who contributed significantly to many fields, including number theory, algebra, statistics, analysis, differential geometry, geodesy (also named geodetics, is a branch of applied mathematics and earth sciences, is the scientific discipline that deals with the measurement and representation of the Earth, including its gravitational field, in a three-dimensional time-varying space), geophysics, electrostatics, astronomy, and optics, had a suggestion where a giant triangle and three squares, the Pythagoras, be drawn on the Siberian tundra. And the outlines of such shapes would have been ten-mile wide strips of pine forest; the interiors could be rye or wheat and all of this was to be done so that if any body from outer space is watching the Earth, they (presumably intelligent ones) would realize Earth is a planet housed by intelligent creatures who are interested to make contact with other alien civilizations! Joseph Johann Littrow, the 19th century Austrian astronomer proposed using the Sahara as a giant blackboard where massive trenches, sizing several hundred yards wide that would cover some twenty-mile wide in Pythagoras type geometric shapes. Then the trenches would be filled with water, and then enough kerosene could be poured on top of the water to burn for six hours. Using this method, a different signal could be sent every night for the attention of other possible planetary beings. The 19th century French poet and inventor Charles Cros was convinced that pinpoints of light observed on Mars and Venus were the lights of large cities and he spent years of his life trying to get funding for a giant mirror with which to signal the Martians. His idea was the mirror would be focused on the Martian desert, where the intense reflected sunlight could be used to burn figures into the Martian sand to get the attention of the Martians. The Serbian-American inventor Nikola Tesla mentioned many times during his career that he thought his inventions like his Tesla coil (an

electrical resonant transformer circuit invented by Nikola Tesla around 1891, used to produce high-voltage, low-current, and high frequency alternating-current electricity) could be used as resonant receiver , which in effect could communicate with other planets. Tesla himself even thought to have observed repetitive signals of what he believed were extra-terrestrial radio communications coming from Venus or Mars in 1899. However, later these signals turned out to be terrestrial radiation.

How to make The Contact

Our science and technological achievements are not so bad, especially if we look at the progress that took place in the last 100 years or so. With our existing scientific wonders, triggered by human aspirations towards the search for alien life-forms, chances are we just might succeed. But time is the crucial factor as the Universe we live in is spectacularly big, as revealed over and over again. And the velocity of the method of our approach of making the contact is also one crucial factor itself. As it is understood, nothing can travel faster than the speed of light (1, 86,000 thousand miles per second, a beam of light can go around the Earth s equator seven times in one second with that spectacular amount of speed), may be if we could achieve a communication method that travels at the speed of light, or at least close to its velocity, chances are we will be able to cover a vast amount of space with shortest amount of time possible. We must also consider the fact that, when we send messages to outer space, we must be extra careful in terms of receiving any data back for our own confirmation so that we know and become aware of what exactly we are dealing with at the first place. Keeping all these in mind, according to experts, there are several ways though which the contact with extra-terrestrial beings can be made. They are: 1) Sending small information gathering probes to space where information can be transmitted back to Earth carrying all the data 2) Use of radio signals, and lastly 3) Use optical signals and lastly using of futuristic and exotic interstellar communication techniques.

Although we will, for the moment, mostly talk about the use of radio technology and how it is perhaps the most suitable form of communication for making such contacts, but let us first understand very briefly on sending probes in space, aiming to make contact with other alien worlds through that technology and in the process, learn better about our cosmic surroundings. Although it is an expensive method of communication but so far it has proven to be very effective in terms of accuracy of message transmission even though it takes a considerable amount of time to receive messages sent by the probes. Mankind has sent several such probes, with peaceful intensions and hoping to make contact with a friendly extra-terrestrial civilization. And more on this has been elaborately discussed in a chapter below titled, Hello E.T, Here we come... .

Now let us talk about the radio communication strategies which are also an extension of the systems that are currently used in the space probes. Before getting into the details on how radio technology can be applied into making contact with beings from another planet, let us first understand what radio technology is at the first place. To put it very simply, radio communication works through radio microwaves. And radio microwaves are a type of electromagnetic radiation and their wavelengths, as per the electromagnetic spectrum, are longer than infrared light. And this energy is used widespread; in almost all forms of wireless communication all over the globe as artificially generated radio waves are used for radio communication, broadcasting, navigation systems, and computer networks. Information is sent off as radio waves from the parent source to its destination where the signal is absorbed and information is translated. Cellular devices, navigation systems, radio devices, and television all use radio waves to communicate with one another.

It is understood that radio waves travel in waves through space and at the speed of light within a vacuum, much like outer space. They have the longest wavelengths in the electromagnetic spectrum and these waves can be as long as a football field or as small as the football

itself. There are many frequencies of radio waves used for a variety of purposes and they all travel differently through the Earth's atmosphere. But one fact remains that radio waves are affected by friction and objects in their way as they travel by line of sight.

It well agreed upon the fact that radio microwave is a great method for generating and receiving signals and one of the main advantages of using radio signals is it is very economical. Microwave signals can be generated cheaply, and can travel longer distances with less degradation than optical signals. The downside of such signaling is the size and complexity of the detection systems and detecting a radio microwave signal requires high-speed computers and sophisticated signal processing hardware and software. Also radio waves are affected by friction and objects in their way as they travel by line of sight; electrically conductive items in particular absorb radio waves very well. Besides another drawback with radio is that the beam spreads significantly over longer distances, with the result that there is less signal power available at the receiving end, unless the receiving antenna is made very wide to catch as much of the signal as possible. The higher the microwave frequency of the radio signal, the less the beam spreads with distance.

All in all, in astronomy, this radio energy is applied in radio telescope which is the instrument of choice for such listening experiments because it is designed to detect longer-wavelength energy that optical telescopes can t see. In radio astronomy, a giant dish is pointed to a nearby sun like star and tuned to the microwave region of the electromagnetic spectrum of that locale. And this microwave frequency band, between 1,000 megahertz and 3,000 megahertz (MHz), is ideal because it s less contaminated with unwanted noise. Over the decades, space communications have indeed used higher and higher frequencies to reduce the beam spreading, with the result that the transmitter on the craft can use lower power while maintaining the same amount of power received at Earth. For interstellar distances, the beam spreading at radio frequencies is enormous. Lastly, radio signals

can travel for a fairly long distance, although they would need to be fairly well-directed and focused. But in this regard one needs to build very large-based telescopes and point them in the general direction of the planet where the message is needed to be sent or directed. So sending radio waves from one planet to another would not be that much of a problem. But here is the main catch. These messages, they would take years to get from one star to the next, so any chance of instant communication is out. We d be able to send messages, but it would take years for a reply, and when that happens none of us would be there to witness or experience it. It is worth mentioning here that humankind has been unintentionally transmitting signals into space, primarily high-frequency radio, television, and radar, for more than sixty years. Our earliest TV broadcasts have reached several thousand nearby stars, although any alien viewers would have to build a very large antenna to detect them.

After radio wave, another method of making contact is the application of optical energy. As light have a much higher frequency and the beam spreading decreases for higher frequency in radio waves, many believe that optical technologies like lasers are very likely to become more common on future deep space probes to distant parts of the solar system because they enable a much higher bandwidth of data to be sent back to Earth for the same amount of power compare to a radio system. One obstacle concerning this method is that over interstellar distances, despite the fact that lasers create a very tight beam; the beam spreading does cause a problem. One key factor is that, the laser also has to be aimed very accurately, and this aim has to be maintained. The tiniest amount of jitter in the craft could cause the beam to miss the target completely. This would be a very tough engineering challenge, combining navigation (so that the craft knows exactly how it is oriented and exactly where the target is) and control (so that it is actually able to point the laser accurately at the target).

And as for futuristic and exotic interstellar communication techniques, the use of gravitational waves or neutrinos to send data in space could

be applied, but further regarding these two will be discussed elaborately in the coming paragraph titled The Big Bright Future .

Hello E.T, Here we come...

There are some mathematical and scientific languages exclusively developed keeping CETI in mind like the Astraglossa that describes a system for combining numbers and operators in a series of short and long pulses where the short pulses represent numbers, while trains of long pulses represent symbols for addition, subtraction, etc. Lincos, an expanded version of Astraglossa was developed by Dutch mathematician Hans Freudenthal focusing on a general purpose language derived from basic mathematics and logic symbols. And of course who can forget Carl Sagan s idea in his science fiction novel Contact where a message might be constructed to allow communication with an alien civilization, using the prime numbers as a starting point. In 2010, SETI (Search for Extra-terrestrial Intelligence institute) scientist Michael W. Busch created a general-purpose binary language which later was used in the Lone Signal (active SETI project designed to send messages from Earth to an extraterrestrial civilization.

Pictorial messages are undoubtedly on of the most visually effective ways of trying to establish contact with an extra-terrestrial civilization. But what is pictorial message? It is understood that pictorial communication systems seek to describe fundamental mathematical or physical concepts via simplified diagrams sent as bitmaps (a representation in which each item corresponds to one or more bits of information, especially the information used to control the display of a computer screen). There are two assumptions concerning the pictorial messages. These messages assume that the recipient has similar visual capabilities (which is a weak assumption) and can understand basic mathematics and geometry (which is a strong assumption because both are prerequisites for building the optimal shape for a radio or optical telescope). However there is a common argument against these pictorial systems is that they assume a shared understanding of special

shapes, which may not be the case with a species with substantially different vision, and therefore a different way of interpreting visual information. For instance, an arrow representing the movement of some object could be interpreted as a weapon firing.

The Pioneer Journeys

And when it comes to pictorial messages we must talk about the pioneer probes, Pioneer 10 and Pioneer 11, parts of the Pioneer program which is a series of United States unmanned space missions that was designed for planetary exploration. And Pioneer 10 and Pioneer 11, launched in 1972 and 1973, are the most important ones of this program where the space-crafts explored the outer planets and left the solar system, each carrying a golden plaque, depicting a man and a woman and information about the origin and the creators of the probes, should any extraterrestrials find them someday. Pioneer 10, traveling an astonishing 25 miles per second, with its Jupiter centric mission, crossed the orbit of Neptune in 1983, the furthest planet away from the Sun at the time, to become the first man-made object to depart the solar system. And in January, 2003, final signal was received from the spacecraft when it was 12 billion kilometers away from Earth and the reception was very weak and subsequent signals were barely strong enough to detect before in reached into the deep space. Pioneer 11, with objectives like, to study the asteroid belt, the environment around Jupiter and Saturn, solar wind, cosmic rays, and eventually venture out to the far reaches of the solar system and heliosphere (a vast region of space surrounding the Sun, a sort of bubble filled by the interplanetary medium and extending well beyond the orbit of Pluto), was the first probe to encounter Saturn and the second to fly through the asteroid belt and by Jupiter. And after several decades of long missions, due to power constraints and the vast distance that the probe went away into, communication with Pioneer 11 was lost on November 30, 1995.

And both of these man-made space crafts carried a 152 by 229 mm (6.0 by 9.0 in) gold-anodized aluminum plaque in case either spacecraft is ever found by intelligent life-forms from another

planetary system. And these plaques were attached to the space machines at the exclusive request of Carl Sagan. The plaques show the nude figures of a human male and female along with several symbols and diagrams of the solar system and the sun's position in space, all of which were intended to serve as a map to Earth for any extraterrestrials who might be curious about the origin of the spacecraft and the creatures that are responsible for creating it!

It all began with the original idea, that the Pioneer spacecraft should carry a message from mankind, was first coined by Eric Burgess (an English freelance consultant, lecturer and journalist) who approached Carl Sagan, the later of whom always had great interest in ways of communicating with extraterrestrial intelligences. And upon Sagan s idea of sending a message with the Pioneer spacecraft, NASA proceeded with the project and together with Frank Drake, Sagan designed the plaque, and the artwork was prepared by Sagan s then-wife Linda Salzman Sagan.

Few words are to be mentioned regarding the symbolism element of that historic plaque. On the right side of the plaque, a man and a woman are shown in front of the spacecraft. The right hand of the man is raised as a sign of good will. Although this gesture may not be understood but it offers a way to show the opposable thumb and how the limbs can be moved which gives some insight to human physiology. Behind the figures of the human beings, the silhouette of the Pioneer spacecraft is shown in the same scale so that the size of the human beings can be deduced by measuring the spacecraft.

At the top left of the plaque is a schematic (diagram-like) representation of the energy transition between the parallel and anti-parallel proton and electron spins in the neutral hydrogen atom, which is the most abundant element in the Universe, to reflect the idea that whoever created this is from the same Universe and has considerable knowledge on how the cosmos functions. Also it is this transition which is responsible for the 21-centimeter line (giving a standard distance) at 1,420 MHz (giving a standard time) by clouds of atomic

hydrogen in space. Thus any space-faring race, it is assumed, would be aware of the significance of this most fundamental transition. The plaque also shows the number 8 in binary (1---) between two tote marks, indicating the height of the Pioneer probe, 152 mm (6 inches).

There are 14 radial lines in the diagram, representing the positions of 14 pulsars relative to the sun. Pulsars emit radio waves at different frequencies, which help identify them. The waves emanate across much of the galaxy, so presumably an alien culture could detect them and locate our solar system. Also, since a pulsar s frequency decreases with time, aliens could use that to determine when the spacecraft was launched. The lengths of the lines show the relative distances of the pulsars to the Sun. A tick mark at the end of each line gives the Z coordinate perpendicular to the galactic plane. An intelligent recipient civilization, it is hoped, would be able to compare its current maps and timings of pulsars with the relative positions and timings given on the Pioneer plaque and, as a result, pinpoint the probe's home star and its year of launch. At the bottom of the plaque is a schematic diagram of the Solar System and again the binary code for each planet indicates its average distance from the sun. The distances are relative to Mercury s distance from the sun, which is given as 10 units. For example, Saturn is 24.7 times farther from the sun than Mercury. Saturn's rings could also give a further hint to identifying the Solar System. Rings around the planets Jupiter, Uranus and Neptune were unknown when the plaque was designed; however, unlike Saturn the ring systems on these planets are not as easily visible and apparent as Saturn's. Also, Pluto was considered to be a planet when the plaque was designed.

It must be mentioned here that the Pioneer plaques have been subject to criticisms, especially around the time they were launched. Many asked whether the aliens would know how to read binary code or how are they (aliens) supposed to know that the binary code represents binary integers (a whole number, either positive or negative, composed of binary digits 0 and 1 representing powers of 2)? Also, will the

beings from other civilization understand that the units of distance and time associated with those integers, in most cases, are derived from properties of the hydrogen atom? And will they make numerous other assumptions required to understand that plaque? Lastly, will they try to interpret the plaque in their own unique way which simply doesn t correspond to the friendly intentions of ours? The risk is surely there but the scientists wanted to make an attempt at communication, and according to experts having chosen binary is a testament to its simplicity and universality.

The Voyagers Voyages

After the pioneer probes next in line for the galactic pictorial message communication process is the Voyager golden records. Launched in 1977, the Voyager probes, Voyager 1 and Voyager 2, both parts of Voyager program, carried two golden records that were inscribed with diagrams depicting the human form, our solar system and its location. Also included were recordings of pictures and sounds from Earth. Official objective of the mission was to study the planetary systems of Jupiter and Saturn which continued throughout the last few decades and on August 25, 2012 Voyager 1 became the first human-made object to enter the previously unexplored region of space known as interstellar space, traveling further than anyone, or anything, in history . And Voyager 2 is expected to enter interstellar space by 2016. All together, The Voyager 1 and 2 probes are currently the farthest human made objects from Earth. They are also two of the fastest man-made objects in space. It was recorded that in March 2012, Voyager 1 was over 17.9 billion km from the Sun and traveling at a speed of approximately 61,000 km/h (38,000 mph), while Voyager 2 was over 14.7 billion km away and moving at approximately 56,000 km/h (35,000 mph).

And as for the Voyager golden records, they are basically gramophone records which were included aboard both Voyager spacecrafts, and they contain sounds and images selected to portray the diversity of life and culture on Earth, and are intended for any intelligent

extraterrestrial life form, or for future humans, who ever may find them in the long run. Even though the Voyager spacecrafts are not heading towards any particular star, but it is believed that Voyager 1 will be within 1.6 light-years of the star Gliese 445, currently in the constellation Camelopardalis, in about 40,000 years. Once again, Carl Sagan played a crucial role in the content selection of the Voyagers golden records. Sagan and his associates assembled 116 images and a variety of natural sounds, such as those made by surf, wind, thunder and animals (including the songs of birds and whales). Along with these they added musical selections from different cultures and eras, spoken greetings in 55 ancient and modern languages.

The collection of images includes many photographs and diagrams both in black and white and color. Some images contain matters of scientific interest, showing mathematical and physical quantities, the Solar System and its planets, DNA, and human anatomy and methods of reproduction. This time not only pictures of humanity, but also some of animals, insects, plants and landscapes made their way into the message. Images of humanity depict a broad range of cultures and these images show food, architecture, and humans in portraits as well as going about their day-to-day lives. Many pictures are annotated with one or more indications of scales of time, size, or mass and all measures used on the pictures are defined in the first few images using physical references that are likely to be consistent anywhere in the universe. The varied musical selection in the record included is artists such as Bach, Mozart, Beethoven, Stravinsky, Guan Pinghu, Blind Willie Johnson, Chuck Berry and Kesarbai Kerkar. There is also the pulsar map and hydrogen molecule diagram, both of which are somewhat similar to that of Pioneer plaque.

It is understood that since the probes are extremely small compared to the vastness of interstellar space, the probability of a space-faring civilization encountering them is very small, especially since the probes will eventually stop emitting electromagnetic radiation meant for communication. Carl Sagan, in his own words, The spacecraft will

be encountered and the record played only if there is advanced space-faring civilizations in interstellar space. But the launching of this bottle into the cosmic ocean says something very hopeful about life on this planet .

The Other Attempts

The Arecibo message, chiefly developed by Frank Drake, the same person who created the Drake equation, was a broadcast message transmitted into space a single time via radio waves on 16 November 1974. The message consisted of a 1679 pixel image with 73 rows and 23 columns and it projected, through radio signals, the numbers one through ten, the atomic numbers of hydrogen, carbon, nitrogen, oxygen, and phosphorus, the formulas for the sugars and bases in the nucleotides of DNA, the number of nucleotides in DNA, the double helix structure of DNA, a figure of a human being and its height, the population of Earth, a diagram of our solar system, and an image of the Arecibo telescope with its diameter. It was aimed at the globular star cluster M13 which is some 25,000 light years away because M13 was a large and close collection of stars that was available in the sky at the time and suitable for the communication process.

Another radio message that deserves recognition in terms of communication efforts with extra-terrestrial life-forms and that one is called Cosmic Call messages, which is basically the name of two interstellar radio messages that were sent from RT-70 (the Yevpatoria RT-70 radio telescope and planetary radar at the Center for Deep Space Communications, Yevpatoria, Crimea, Autonomous Republic of Crimea, previously in Ukraine) in 1999 and 2003 to various nearby stars. Cosmic Calls included mathematically-encoded scientific messages about our solar system, our planet, and us. The messages broadly consisted of a few digital sections that included the copy of Arecibo Message, Bilingual Image Glossary (a dozen hand drawings meant to show concepts including people, family, nature and games, with English and Russian words attached), the Braastad message (a message written by American science writer Richard Braastad), as well

as text, audio, video and other image files submitted for transmission by everyday people around the world.

After the Cosmic Call messages, there is Teen Age Message (TAM) which was a series of interstellar radio transmissions sent from the Yevpatoria Planetary Radar to six solar-type stars during August September 2001. TAM was organized by Russian scientist Alexander Zaitsev and the message's content and target stars were selected by a group of teens from four Russian cities, who collaborated in person and via the Internet. The content of this message contained three parts. First one represents a coherent-sounding radio signal with slow Doppler wavelength tuning to imitate transmission from the Sun's center. This signal was transmitted in order to help possible extraterrestrials detect the TAM. Part 2 is analog information representing musical melodies performed on the Theremin which is an early electronic musical instrument controlled without physical contact by the Thereminist (the Theremin performer). This electric musical instrument produces a quasi-monochromatic signal, which is easily detectable across interstellar distances. And lastly the part 3 represents well-known Arecibo-like binary digital information that consists of the logotype of the TAM, bilingual Russian and English greeting to aliens and image glossary.

SETI & Project Ozma

When we talk about trying to make contact with extra-terrestrial civilizations, we must consider the contribution of the SETI Institute (Search for Extra-terrestrials Institute) and her works on this grand quest on behalf of mankind. To be precise, the SETI Institute is a not-for-profit organization whose mission is to explore, understand and explain the origin, nature and prevalence of life in the Universe . Programs of this organization include applying both the radio and optical telescopes to search for deliberate signals from extraterrestrial intelligence while other includes research in the discovery of extra-solar planets, potentials for life on Mars and other bodies within the Solar System, and the habitability of the galaxy.

It all began back in 1959, when two Cornell physicists Giuseppi Cocconi and Philip Morrison published an article in Nature in which they pointed out the potential for using microwave radio to communicate between the stars. In that year, Frank Drake, who was then just a young radio astronomer, had independently reached the same conclusion, and in the spring of 1960 conducted the first microwave radio search for signals from other solar systems. For two months Drake aimed an 85-foot West Virginia antenna in the direction of two nearby Sun-like stars. His single-channel receiver was tuned to the magic frequency of the 21 cm (1,420 MHz) line of neutral hydrogen, a spot on the radio dial also favored by Cocconi and Morrison because of its astronomical significance. While he didn't detect any signal of extraterrestrial origin, Drake s this effort, widely known as Project Ozma spurred the interest of others in the astronomy community, most immediately the Russians. But more on Project Ozma later.

At the beginning of the 1970's, NASA's Ames Research Center in Mountain View, California began to consider the technology required for an effective search. A team of outside experts, under the direction of Bernard Oliver (electrical engineer by training and according to SETI, one of the most influential figures in the modern search for extraterrestrial intelligence), on leave from the Hewlett-Packard Corporation, produced a comprehensive study for NASA known as Project Cyclops. The Cyclops report provided an analysis of SETI s science and technology issues that is the foundation upon which much succeeding work of SETI is based. In SETI, there are two basic search strategies and they are, first, the sky surveys that sweep a telescope over large areas of the sky looking for strong signals that may come from any direction and secondly, the targeted searches point a telescope at the direction of selected stars.

As the perception grew that SETI had a reasonable prospect for success, people began taking interests in SETI and by the late-1970's, SETI programs had been established at NASA's Ames Research

Center and at the Jet Propulsion Laboratory (JPL) in Pasadena, California. These groups arrived at a dual-mode strategy for a large-scale SETI project. Ames would examine 1,000 Sun-like stars in a Targeted Search, capable of detecting weak or sporadic signals and JPL would systematically sweep all directions in a Sky Survey. In 1988, after a decade of study and preliminary design, NASA Headquarters formally adopted this strategy, and funded the program and four years later, on the 500th anniversary of Columbus' arrival in the New World, the observations finally began. Sadly within a year, American Congress terminated the funding for SETI.

It is understood that from 1990, no US government funds are allocated for SETI searches and these days whatever the funding is there it comes entirely from private contributions. Although NASA pulled the plug however, the two continued to work together with common objectives and one such crucial one was called Project Phoneix. By definition, Project Phoenix was the world's most sensitive and comprehensive search for extraterrestrial intelligence. It was an effort to detect extraterrestrial civilizations by listening for radio signals that were either being deliberately beamed our way, or was inadvertently transmitted from another planet. And project Phoenix concentrated efforts on that particular component of the NASA SETI project known as the Targeted Search. Its strategy was to carefully examine the regions around 1,000 nearby Sun-like stars. Rather than attempting to scan the whole sky for messages, the Project concentrated on nearby systems that are similar to our own. Project Phoenix's targets comprised about 800 stars with a 200 light-year range. In March 2004 the Project announced that after checking the 800 stars on its list, it had failed to find any evidence of extraterrestrial signals. Project leader Peter Backus remarked that they had been forced to conclude that we live in a quiet neighborhood . During this Project Phoneix the Catalog of Nearby Habitable Systems (HabCat), a catalogue of star systems that are likely to have habitable planets, was developed and at present the list contains a staggering 17, 129 such HabStars .

SETI is still going strong with many long-term projects. Among these is a venture called Project SERENDIP operated by the University of California, Berkeley at the Arecibo telescope. Another is a joint project with UC Berkeley, where SETI is building a telescope (named the Allen Telescope Array) that will equal a 100-meter radio telescope. It is the forerunner of other larger radio astronomy projects planned for the future decades.

Few words are also in order concerning the SET@home which is an Internet-based public volunteer computing project employing the BOINC software platform, hosted by the Space Sciences Laboratory, at the University of California, Berkeley, in the United States. Its purpose includes analyze radio signals and search for signs of extra terrestrial intelligence. The two core objective of this special SETI project is to do useful scientific work by supporting an observational analysis to detect intelligent life outside Earth, and to prove the viability and practicality of the volunteer computing concept. Although, so far, this project has not confirmed the detection of any extraterrestrial intelligence, however, it has identified several candidate targets and the most significant candidate signal to date was announced on September 1, 2004, named Radio source SHGb02+14a which the scientist believe require a great deal of attention and further research. It is important to mention here that as it is known that SETI is an attempt to send messages to intelligent extraterrestrial life, METI (Messaging to Extra-Terrestrial Intelligence) science deals with the creation of messages to aliens. METI pursues not a local and lucrative desire, but a more universal and unselfish one, to overcome the Great Silence in the Universe, bringing to our extraterrestrial neighbors the possible long-expected annunciation You are not alone! and gladly learn that we aren t either.

Now let s understand few things about the legendary experiment called Project Ozma and how it pioneered mankind s search process of seeking alien life in the Universe. Project Ozma was a ground-breaking SETI experiment that started in 1960 by Cornell University astronomer

Frank Drake, at the National Radio Astronomy Observatory at Green Bank, West Virginia. The object of the experiment was to search for signs of life in distant solar systems through interstellar radio waves. The program was named after Princess Ozma, ruler of the fictional Land of Oz, a place very far away, difficult to reach, and populated by strange and exotic beings , the fantasy region containing four lands under the rule of one monarch, as depicted in the illustrated children s novel The Wonderful Wizard of Oz (1900) by author L. Frank Baum.

In 1960, radio astronomer Frank D. Drake, then at the National Radio Astronomy Observatory (NRAO) in Green Bank, West Virginia, carried out humanity's first attempt to detect interstellar radio transmissions. The stars chosen by Drake for the first SETI search were Tau Ceti in the Constellation Cetus and Epsilon Eridani in the Constellation Eridanus, some eleven light years (66 trillion miles) away. Both stars are about the same age as our sun.

From April to July 1960, for six hours a day, Project Ozma's 85-foot NRAO radio telescope was tuned to the 21-centimeter emission (1420 MHz) coming from cold hydrogen gas in interstellar space. The astronomers scanned the tapes for a repeated series of uniformly patterned pulses that would indicate an intelligent message or a series of prime numbers such as 1, 2, 3, 5 or 7. The receiver was tuned to wavelengths near 21 cm, which is the wavelength of radiation emitted naturally by interstellar hydrogen; it was thought that this would be familiar, as a kind of universal standard, to anyone attempting interstellar radio communication. With the exception of one early false alarm caused by a secret military experiment, the only sound that came from the loudspeaker was static and noises, naturally caused by the Universe. Even though the project itself was not a success, but Project Ozma certainly paved the way for systematic searches with feasible scientific objectives for the alien civilizations on the planets of other stars.

All in all, some say extra-terrestrial life, especially the one with an intelligent civilization is so far away that in mankind s history we will never make contact with them, for better or worse.

And then again some say life beyond our planet is just within our reach.

The Wow! Signal

On August, 15, 1977, a strong radio signal was detected by SETI at the Big Ear radio telescope of The Ohio State University, which was back then located at Ohio Wesleyan University's Perkins Observatory in Delaware, Ohio. Mysteriously the signal had the expected hallmarks of non-terrestrial and non-Solar System origin and it lasted for the full 72 second window that Big Ear Radio telescope was able to observe it. But sadly the massage was never detected again after numerous attempts. That particular signal is known as the Wow! Signal and the reason why it is referred as the Wow! signal is because, surprised at how closely the signal matched the expected signature of an interstellar signal, scientists Jerry R. Ehman who detected the signal, circled the signal on the computer printout and penned down the comment "Wow!" on its side. And hence the comment became the name of the signal.

The location of this yet unresolved cosmic signal, which was thirty times stronger than the background noise, was traced back to the constellation Sagittarius, near the Chi Sagittarii star group. The radio signal appeared to fit the criteria for an extraterrestrial radio signal, but as it wasn t heard again, the follow-up studies that were essentially required to either confirm or deny the fact that either this message was truly from an extra-terrestrial civilization or the signal was just another cosmic natural phenomena, were not possible. But few facts remain quite thought provoking regarding this mysterious radio signal. Amateur astronomer Robert Gray, in his book The Elusive Wow tried to point out some crucial factors about this enigmatic signal that took place some 35 years ago or so. According to his book that came

out in 2011, first, it did appear to be an artificial radio signal, rather than a natural radio emission such as a pulsar or quasar. The Big Ear telescope, on that occasion, used a receiver with 50 radio channels; the signal was only heard on one frequency, with no other noise on any of the other channels. A natural emission would cause static to appear on all of the frequencies, and interestingly enough, for the Wow! signal, this was not the case. The signal was narrow and focused, as would be expected from an artificial source. The signal also rose and fell during the 72 seconds, as would be expected from something originating in space, that is artificial in nature. When the radio telescope is pointed at the sky, any such signal will appear to increase in intensity as it first moves across the observational beam of the telescope, then peak when the telescope is pointed straight at it and then decrease as it moves away from the telescope. This also makes a mere computer glitch a less likely explanation, although not impossible. Satellites often seem to be an obvious possible explanation, but as author Robert Gray notes, a satellite would have to be moving at just the right distance and at just the right speed, to mimic an alien signal. But then why wasn t it observed again? An orbiting satellite will broadcast its signal repeatedly. Had it been a signal from some Earthly made satellite, then surely the signal would ve been caught by the Big Ear s scientists once again and at least in predictable repetitions. But that wasn t the case. The signal was also observed near the 1420 MHz frequency, a protected spectrum in which terrestrial transmitters are forbidden to transmit as it is reserved for astronomy research related purposes.

To some extent there are some prejudices to our end in thinking that any alien signals will be like ours, that is signal or massages sending out to space continuously, much like normal radio emissions from every-day type technologies which could easily be seen on an ongoing and routine basis. But what if the Wow! signal was something more like beacons, sent out intentionally but only on a periodic basis? As Gray explains, radio searches to date have tended to look at many

different spots in the sky, but they will only examine any particular spot for a few minutes or so before moving on to the next. A periodic signal could easily be missed completely, or if seen, it may be a long time before it is seen again. Perhaps that, to some extent explains why that particular signal was never heard of again.

Also this signal was very sharp, transmitting at only a single frequency. It is understood that natural radio sources don t work like that. They tend to spread across a range of frequencies, meaning that the same signal covers a broad band of transmission. The Wow! signal is not like this at all, showing only one very specific frequency at approximately 1420 MHz. 1420 MHz, also known as the hydrogen line, is a frequency internationally banned from use by terrestrial radio signals because of its use in radio astronomy. As if the source of The Wow! signal knew the special significance of this key radio frequency.

The Wow! signal still hasn t been scientifically explained, although various theories have been suggested over the years to shed light on its mysteriousness nature. Despite a lot of efforts, no identification has been found for the signal s source, and no repetition of such signal has ever been found. It remains a complete mystery. Perhaps one day it will be heard again, or another one much similar like it and perhaps the ambiguity of this signal will be solved once and for all.

Another radio signal that is worth mentioning in this regard is the Radio source SHGb02+14a, discovered in March 2003 by SETI@home and announced in New Scientist magazine on September 1, 2004. This radio signal was observed only three times at a frequency of about the same 1420 MHz, one of the frequencies in the waterhole region, which is theorized to be a good candidate for frequencies used by possible extraterrestrial intelligence to broadcast contact signals. Now, Waterhole refers to an especially quiet band of the electromagnetic spectrum between 1,420 and 1,666 megahertz, corresponding to wavelengths of 21 and 18 centimeters respectively. Hydroxyl molecules, composed of one atom of hydrogen and one atom of oxygen (OH), emit at four specific radio frequencies ranging from

1612 MHz to 1720 MHz. When a hydrogen atom combines with a hydroxyl molecule it forms a molecule of water, the most essential molecule for life as we know it and water is naturally vital enough for any extraterrestrial life to grow and evolve into an advanced civilization, enough to generate radio signals.

False Alarms

Not all radio signals are mysterious though, even if they generate a similar enthusiasm at the beginning. CTA 102 is a quasar discovered in the early 1963 by a radio survey carried out by the California Institute of Technology. When it was discovered for the first time, its source of origin was unidentified and was thought to be a radio signal by an extraterrestrial civilization. But only later it was realized that the signal was actually coming from a quasar (a massive and extremely remote celestial object, emitting exceptionally large amounts of energy, which typically has a star like image in a telescope. It has been suggested that quasars contain massive black holes and may represent a stage in the evolution of some galaxies). Another false alarm was the PSR B1919+21, which is now categorized as a pulsar (a celestial object, thought to be a rapidly rotating neutron star, that emits regular pulses of radio waves and other electromagnetic radiation at rates of up to one thousand pulses per second). Discovered in 1967 astrophysicist Jocelyn Bell and her the then PhD adviser, radio astronomer Antony Hewish and both scientists thought that the power and regularity of the signals resembled a beacon coming from some extra-terrestrial civilization and they were so excited about their discovery that they even named it, at first, LGM-1 , where LGM stood for Little Green Men , the common nickname for extra-terrestrial beings amongst the alien enthusiasts. Even though the message did not originate from any Little Green Men but this discovery sure was a historical one as it was later realized for the first time that these signals were actually coming from rotating neutron stars (the collapsed core of a supernovae, which takes place when the outer region of a star gets blown off in a tremendous explosion). And these neutron stars were emitting pulses

of radio waves because of a complicated interaction between their magnetic fields and surrounding matter. The researchers later noticed that the signals coincided with the position of a flashing star located at the centre of the Crab Nebula, the very locale where the remnant of a supernovae that was seen from Earth in 1054 AD.

Why this mistake concerning a pulsar? For that we need to understand the nature of a neutron star. A neutron star has the core of neutrons (the uncharged particles, very similar to proton) around which lies a fluid layer that is itself made up of neutrons, protons and electrons. The rotational power of the original star remains preserved in neutron star. As a result, the neutron star can spin very fast, between 1000 times and to even just once every single second. A neutron star is also very intense given the fact that a star's original magnetic power is also condensed in it. What happens eventually is that, charged particles like protons and electrons are accelerated and get caught up by the neutron star's magnetic field and spin around to emit radio waves in narrow beams at the magnetic poles of the star. And when the rotational axis of such star is not aligned with the axis of the magnetic field, the beam of the radiation sweeps across the sky, delivering short radio waves.

So far, hundreds of pulsars have been identified by astronomers worldwide. Crab Pulsar, one that was discovered by Jocelyn Bell, is perhaps the most carefully studied of all the known pulsars discovered so far. One of the most exceptional properties of this particular pulsar is that it emits radiation at all observable wavelengths, from radio wavelengths, through visible light to the highest-energy X-rays. It is believed that the younger the pulsar, the faster is its speed of rotation. Crab pulsar, formed a little over 900 years ago, rotates about 30 times per second whereas Vela pulsar, which is about 10,000 years old and found in a partially dispersed supernova remnant, rotates about 11 times per second. Scientists believe, pulsars will no longer be able to emit its radiation once its rotational rate dies out completely and eventually it'll shut off.

At this point one important factor must be mentioned and that is there is a way to be sure if the message is from intelligent extra-terrestrial world or not. As it is known that all radio SETI experiments look for narrow-band signals which are radio emissions that extend over only a small part of the radio spectrum. Narrow-band signals, perhaps only a few Hertz wide or less are the mark of a purposely built radio transmitter. Natural cosmic noisemakers, such as pulsars, quasars, and the turbulent, thin interstellar gas of our own Milky Way, do not make radio signals that are this narrow to that mentioned extent. Any signal less than about 300 Hz wide must be, as far as we know, artificially produced. In terrestrial radio practice, such narrow-band signals are often called carriers . They pack a lot of energy into a small amount of spectral space, and consequently are the easiest type of signal to find for any given power level. If E.T. intentionally sends us a signal, those signals may well have at least one narrow-band component to get our attention. Such narrow-band signals are what all SETI experiments look for. Other tell-tale characteristics include a signal that is completely polarized (which is a property of radio waves that can oscillate (movement back and forth in a regular rhythm) with more than one orientation) or the existence of coded information on the signal.

Also, one crucial fact remains that there is no guaranty that we will for sure understand absolutely the intention and the meanings of an alien radio message. It is somewhat possible that an advanced and hopefully selfless civilization will send us simple pictures and other information and they are likely to do this because they are hundreds (or more) light-years distant. That would make real back-and-forth communication tedious at best, so these alien broadcasters might be tempted to send some basic information about them and in a format that we could eventually and easily decipher. Then again, experts also believe that we might even end up picking up a signal that was never intended for us, in which case it might be impossible to figure it out. But it is a possibility that we ll know only a few things about the

beings on the other end when that later situation occurs. We can pinpoint the spot on the sky where the signal is coming from, and information regarding its chosen frequency will also tell us something about the rotation and orbital motion of E.T. s home planet.

Magical Meteorites & the Falling Aliens

As it is known already that some meteorites may contain life-forms that are indeed, could be extra-terrestrial in origin, and this has sparked a great deal of research in the meteorites, aiming to find clues in man s quest for the possibility of life from out side of this Earthly arena. And surely there have been quite notable ones too. For example, The Murchison meteorite, named after Murchison, Victoria in Australia, is one of the most studied meteorites due to its large mass (over 100 kg), the fact that it was an observed fall, and that it belongs to a group of meteorites rich in organic compounds! It all began on 28th September of 1969 when a bright fireball was observed to separate into three fragments before disappearing, leaving a cloud of smoke and about 30 seconds later, it impacted near the town of Murchison. Research has shown that this particular meteorite belongs to those meteorite groups which experienced extensive alteration by water-rich fluids on its parent body (asteroids or comets), before falling onto Earth. Also over 15 amino acids, some of which are basic components of life itself, like glycine, alanine and glutamic acid were believed to have been found on that meteorite! This tells scientists that many organic compounds which are basic elements of life on Earth were present in the early Solar System of ours and very possibly elsewhere in the Universe, with potentiality to trigger the origin and flourishing of extra-terrestrial life.

Another meteorite of great interest as well of one with a great historical significance is the Nakhla meteorite, the famous Martian meteorite that was fallen in Egypt in 1911 and the first one to suggest the presence of water on Mars and the prototype for all Nakhlite type of meteorites. Nakhlite meteorites are categorized as those types of meteorites that are thought to have originated from Mars, primarily ejected from the planet by the impact of another large body colliding with the Martian surface and then believed to have traveled through the

solar system for an unknown period of time before penetrating the Earth's atmosphere. Research has shown that the rock contains carbonates and hydrous minerals, formed by chemical reactions in water and in addition, the rock was also exposed to Martian water after it was formed, which caused secondary accumulations of minerals. But the spectacular nature of this premier Nakhla meteorite did not stop there.

In 1999, a team from NASA's Johnson Space Center examined the Nakhla meteorite, after receiving part of the meteorite from the British Museum, the resting place of the meteorite, with the aid of an optical microscope and a powerful scanning electron microscope (SEM), discovered biomorphic (resembling or suggesting the forms of living organisms) forms of a limited size range in the meteorite. Once again in 2006, London's Natural History Museum, which holds several intact fragments of the meteorite, allowed NASA researchers to break one such fragment open which was basically a fresh sample, provided that it was relatively free from Earth-sourced contamination. These scientists found an abundance of complex carbonaceous (consisting of or containing carbon or its compounds) material occupying the pores and channels in the rock, resembling the effects of bacteria observed in rocks on Earth.

There is another meteorite that has been subject to many debates and that is the Polonnaruwa meteorite is an alleged meteorite that fell in 29th December 2012, close to the city of Polonnaruwa in Sri Lanka, and recovered and studied by Sri Lankan-born British mathematician, astronomer and astro-biologist Chandra Wickramasinghe and his team. The far-Eastern scientist published his findings regarding this meteorite in the Journal of Cosmology and announced that after studying some electron micrographs (a micrograph or photo-micrograph, is a photograph or digital image taken through a microscope or similar device to show a magnified image of an item. This is opposed to a macro-graphic image, which is at a scale that is visible to the naked eye), his team discovered fossilized diatoms (microscopic phytoplankton) inside the meteorite as well as cells similar to those found in the Red rain in Kerala that fell in 2001.

The Kerala red rain phenomenon was a red rain event that occurred from 25th July to 23rd September, 2001, when heavy downpours of red-colored rain fell sporadically on the southern Indian state of Kerala, staining clothes pink. Along with red, yellow, green, and black rain was also reported. And this wasn t the first of such bizarre incident. Colored rain was also reported in Kerala in 1896 and several times since, and even as recently as in June 2012. Following a light microscopy (microscope consisting of an optical instrument that magnifies the image of an object) examination, it was initially thought that the rains were colored by fallout from a hypothetical meteor burst, but a study commissioned by the Government of India concluded that the rains had been colored by airborne spores from locally prolific terrestrial algae. But in 2006 that the colored rains of Kerala gained widespread attention when the popular media reported that physicist Godfrey Louis and Santhosh Kumar of the Mahatma Gandhi University in Kottayam proposed a controversial argument that the colored particles that caused the Red Rain in Kerala were, in fact extra-terrestrial cells, coming from outer space and caused the unusual coloring of rain, upon contact with Earthly atmosphere. But this claim has been subject to many controversies and debates and so far no definite proof emerged that could confidently state that extra-terrestrial cells are responsible for those red rains in Kerala and elsewhere.

Shergotty meteorite is another Martian meteorite that also indicated the presence of liquid water on Mars. Weighing about 5 Kg, this olden Martian meteorite which fell to Earth at Shergotty (now Sherghati), in the Gaya district, Bihar, India on 25 August 1865. Upon examination, it was found that the cosmic object was composed mostly of pyroxene (any of a large class of rock-forming silicate minerals, generally containing calcium, magnesium, and iron and typically occurring as prismatic crystals) and is thought to have undergone pre-terrestrial aqueous (presence of liquid water) alteration for several centuries and certain features within its interior are suggestive of being remnants of biofilm (a biofilm is any group of microorganisms in which cells stick to each other on a surface) and their associated microbial communities.

Yamato 000593 is another Martian meteorite that impacted on Earth, specifically in Antarctica about 50,000 years ago and upon study, showed that evidences of water alteration on Mar s surface. And further research, at a microscopic level, discovered that spheres are found within the meteorite that are rich in carbon compared to surrounding areas that lack such spheres. According to NASA scientists, the carbon-rich spheres and the observed micro-tunnels may have been formed by biotic (biotic describes a living or once living component of a community; for example organisms, such as plants and animals) activity.

Some studies even claim that there are living alien cells in the stratosphere (the second major layer, one of the five, of, just above the troposphere, and below the mesosphere). For example, on the 20th January of 2001, the Indian Space Research Organization (ISRO) conducted a balloon flight from Hyderabad, India to collect stratospheric dust from a height of 41 km with a view to testing for the presence of living cells. The participants on this project included a team of UK scientists led by the same Polonnaruwa meteorite famed Sri Lankan born British scientist Wickramasinghe. In a paper presented at a SPIE (a not-for-profit international professional society for optics and photonics technology) conference in San Diego in 2002, he concluded that the detection of evidence for viable microorganisms from 41 km above the Earth s surface was presented and that was a crucial finding of his research. However, the experiment did not present any evidence as to whether the findings are incoming microbes from space rather than microbes carried up to 41 km from the surface of the Earth. Again on 2005, the ISRO group carried out a second stratospheric sampling experiment from 41 km altitude and reported of three new species of bacteria including one that they named *Janibacter hoylei sp.nov.* in honor of Fred Hoyle (the English astronomer noted primarily for the theory of stellar nucleosynthesis and his often controversial stances on other cosmological and scientific matters in particular his rejection of the Big Bang theory , a term originally coined by him on BBC radio show). However, experts suggest that these facts do not prove that bacteria are non-Earthly in origin and the

scientists themselves who were involved in that study here have refrained from linking these discoveries to the panspermia theory.

The Big Bright Future

What is the future of the search for extra-terrestrial life-forms, intelligent or otherwise? With so many numerous other problems that are plaguing the world, how much priority should this particular brand of human interest be given? The answer is, a lot. The fact remains that we owe the answer to ourselves the answer to the question whether we are alone in this Universe or not. And thus the research and scientific efforts should continue and must enjoy well earned precedence in man s quest for his cosmic neighbors.

It is understood that the vast spatial nature of the Universe makes our search a very challenging one. Say for example, it would take Pioneer 10 probe, with its spectacular speed of covering 25 miles per second, about 33,000 years to reach Proxima Centuri, the closest star system to ours and a trip across our milky way to the Andromeda galaxy, with the same Pioneer 10, would take about 15 billion years, which is as long as the Universe and time existed!

Different space exploration organizations are initiating numerous projects in the coming future aiming to understand our mysterious Universe as well as to know our familiarly unique solar system and her habitants. Let s take Europa Clipper for example, a mission concept under study by NASA that one day would conduct detailed reconnaissance of Jupiter's moon number sixth, Europa and would investigate whether it has conditions suitable for life which many speculate is a great possibility as we have already discussed that earlier in the 3rd chapter s paragraph titled The Jupiterian Sixth . There ve been many missions to Mars where some important discoveries have already been made. But more research is underway and scientists are planning to send more probes to learn more about this big red planet. And one of them is ExoMars, a large Mars mission to search for bio-signatures of Martian life, past or present. This astrobiology mission is

currently under development by the European Space Agency (ESA) in collaboration with the Russian Federal Space Agency (Roscosmos). This important Martian exploration program includes several spacecraft elements to be sent to Mars on two launches. One of them is called the ExoMars Trace Gas Orbiter (TGO) and this TGO would deliver the ESA-built stationary Lander and then proceed to map the sources of methane on Mars and other gases, and in doing so, help select the landing site for the ExoMars rover to be launched on 2018 on a Russian heavy lift Proton launch vehicle. The TGO will feature four instruments and will also act as the communication relay satellite for the follow up rover. And as for the second launch, in 2018 a Roscosmos-built Lander is to deliver the ESA-built rover to the Martian surface and the rover will also include some Roscomos built instruments all of which will study the mysterious planet.

Many of the future space exploration projects are centered on planet Mars. And this is because Mars is accessible, just a few months of travel time from the Earth. It also has compelling evidence for a history of liquid water on its surface, which is the key requirement we know for life. None of the other planets in our solar system seems suitable enough to receive that level of priority for many reasons. Even though the two moons, Europa and Titan, are of potential interest to astro-biologists, but they are much farther than Mars and more difficult to reach with spacecraft. And while there are indeed thousands of exo-planets (or exo-planet candidates) that have been discovered, we have no way at present of assessing their habitability. In any event, they are far too distant for spacecraft visits in the foreseeable future. So Mars, by far is the best option that is likely to yield the maximum of results for such cosmic ventures.

Another proposed Martian mission is Mars Sample Return (MSR) mission that is to be a spaceflight mission to collect rock and dust samples from Mars and to return them to Earth. This MSR would be a very powerful type of exploration, because analysis is freed from the time, budget, and space constraints of spacecraft sensors. And all

of Earth's laboratories could potentially study a sample, at least that s the plan with it. According to Louis Friedman, Executive Director of The Planetary Society, a Mars Sample Return mission is often described by the planetary science community as the holy grail of robotic space missions, due to its high expected scientific return-on-investment. The Mars 2020 rover mission is another Mars planetary rover mission concept under study by NASA with a possible launching schedule sometime in 2020. It is intended to investigate an astro-biologically relevant ancient environment on Mars, examine its surface geological processes and history, including the assessment of its past habitability and potential for preservation of bio-signatures within accessible geological materials.

One future mission that is one of great interest, even though it s not Mars centric, is the Bracewell probe. A Bracewell probe, an idea to begin with was first proposed by radio astronomer Ronald N. Bracewell in a 1960 paper, as an alternative to interstellar radio communication between widely separated civilizations, is a hypothetical concept for an autonomous interstellar space probe launched with the aim of communicating with one or more alien civilizations. A Bracewell probe would be constructed as an autonomous robotic interstellar space probe with a high level of artificial intelligence, and all relevant information that its home civilization might wish to communicate to another culture. It would seek out technological civilizations and along with that alternatively monitor worlds where there is a likelihood of technological civilizations arising and communicate over short distances (compared to the interstellar distances between inhabited worlds) once it has discovered a civilization that meets its contact criteria. It would make its presence known, carry out a dialogue with the contacted culture, and presumably communicate the results of its encounter to its place of origin, which is Earth. In essence, such probes would act as an autonomous local representative of their home civilization (Earth) and would act as the point of contact between the cultures, Earthly and

extra-terrestrial. Since a Bracewell probe can communicate much faster, over shorter distances, and over large spans of time, it can communicate with alien cultures more efficiently than radio message exchange might. The disadvantage to this approach, however, is that such probes cannot communicate anything that is not in their data storage, nor can their contact criteria or policies for communication be quickly updated by their base of operations .

Unquestionably interstellar travel is a big challenge. The easiest option we have at the moment is interstellar communication through radio signals between planetary systems, much like the SETI Institute initiative. Where radio signals, being transmitted by possible extra-terrestrial civilizations located outside the solar system, could be detected, primarily through the radio frequencies of the electromagnetic spectrum (the entire range of wavelengths or frequencies of electromagnetic radiation extending from gamma rays to the longest radio waves and including visible light). And in this regard special attention should be given, as it is already understood, to the Water Hole regions, the frequency of one of neutral hydrogen s absorption lines, due to the low background noise at this frequency and its symbolic association with the basis for what is likely to be the most common system of biochemistry, and thus the possibility of sustenance of life. Some other inter-stellar communication suggestions include, higher frequency signals, such as lasers operating at visible light frequencies, may prove to be a fruitful method of interstellar communication. Some other more exotic and high-tech methods of such possible communication methods include controlled neutrino (a neutral subatomic particle with a mass close to zero and half-integral spin, which rarely reacts with normal matter. Three kinds of neutrinos are known, associated with the electron, muon, and tau particle). The interesting fact about neutrinos is that, they are very small, they have no charge; they have no mass; they do not interact at all and any object, no matter how big or small, neutrinos simply pass through it like photons through a sheet of glass. Many scientists believe that

neutrinos, in a highly controlled state, could have the ability to establish a viable interstellar communication system.

And much like the neutron theory, another proposed communication idea is the gravitational wave theory, in physics gravitational waves are ripples in the curvature of space time (a property of space near massive bodies in which their gravitational field causes light to travel along curved paths) that propagate as a wave, traveling outward from the source. Predicted in 1916 by Albert Einstein to exist on the basis of his theory of general relativity, gravitational waves theoretically transport energy as gravitational radiation and the proposed idea is that that gravitational radiation could be used to convey messages to extra-terrestrials as a part of the interstellar communication program. Even though both of these inter-stellar communication ideas could have the advantage of being essentially immune to interference by any cosmic intervening matter, but are very difficult to generate or detect with existing technology that are possessed by mankind.

The Antimatter Rocketry

As it is understood that interstellar travel is far more complicated than interstellar communication but we simply can t disregard the possibility as well as the human aspiration of physically traveling to various extents of space and explore planets and other wonders of cosmos for knowledge and perhaps for some interstellar companionship. Although we know that with the existing technology, interstellar travel to distant planets is something that is very difficult to achieve but there are possibilities though which such cosmic travel may very well be possible.

It is acknowledged that, at present, no propulsion (the action of driving or pushing forwards) engine (man made that is) generates superluminal speeds (having a speed greater than that of light, as light travels at the rate of 1,86,000 miles per second) and the very laws of physics prevent us from doing that. But there is a possibility that we will be able to go many times faster than our current propulsion methods allow. The

mechanism of an antimatter engine will take us far beyond our solar system and let us reach nearby stars in a fraction of the time it would take a spacecraft propelled by a liquid-hydrogen engine, like the one used in the present day space shuttle engines. It's like the difference between driving a state-of-the-art Indy race car and a 1960 Toyota. In the Toyota, the driver will eventually make it to the finish line, but it will take 10 or more times longer than in the Indy race car. Now before we understand how an antimatter powered engine will function in an interstellar journey, we must first understand what antimatter is.

One of the mystifying aspects of the Universe is Antimatter. It is understood that matter is made of electrons, protons and neutrons whereas antimatter is identical to matter, except that it is composed of anti-electrons, antiprotons and antineutrons. When antimatter comes into contact with normal matter, they collide to produce an explosion emitting pure radiation. And this results in a complete annihilation of matter into energy. Every particle in the Universe has the common characteristics of mass and charge. However, with antimatter, the mass of the particle remains constant, while its electric charge is opposite. A normal matter such as a hydrogen atom contains 1 electron and 1 proton. The anti-particle, the anti-hydrogen atom, will have 1 positron (the antiparticle of an electron, which has the same mass as an electron but opposite electric charge) and 1 antiproton. Similarly, the antiparticle of proton is antiproton which has the same mass as a proton, but with opposite charge, while the antiparticle of the neutron is an antineutron. This is why, after collision, the entire mass of both particles transforms into pure energy, a phenomenon that scientists believe, may usher an era of traveling at the speed of light. And the modern quest of antimatter began back in 1928 by physicist Paul Dirac.

It is now well known that, for every atomic and subatomic particle, there is an antiparticle. But how did antimatter come into being? Just like everything else, right after the Big Bang. Scientists believe that, immediately after creation of the universe, there were almost the same

amount of antimatter as there was matter. But the cosmic process compelled them to annihilate each other out and eventually ushering today's matter-dominated Universe. Many leading scientific minds at CERN's Large Hadron Collider (Large Hadron Collider or LHC is the world's largest and most powerful particle collider, built by the European Organization for Nuclear Research, also known as CERN), believe that there are antiparticles still out there in the Universe. Scientists think that antimatters are created whenever high-energy particle collisions take place in the universe. Studies have found that when cosmic rays impact Earth's atmosphere, small quantities of antiparticles are produced in particle jets and these antiparticles are destroyed as soon as they come in contact with nearby matter. It is also believed that antimatter may still exist in large amounts in distant galaxies because of the inflation associated with the early expansion of the universe.

When antimatter comes into contact with normal matter, these equal but opposite particles collide to produce an explosion emitting pure radiation, which travels out of the point of the explosion at the speed of light. Both particles that created the explosion are completely annihilated, leaving behind other subatomic particles. The explosion that occurs when antimatter and matter interact transfers the entire mass of both objects into pure energy. Scientists believe that this energy is more powerful than any that can be generated by other propulsion methods and can be applied to modern rocketry aimed at interstellar voyages. The antimatter rocket should be the kind of rocketry technology that uses rockets that apply antimatter as their power source. The advantage to this class of rocket is that a large fraction of the mass of a matter/antimatter mixture/collision/reaction may be converted to energy, allowing antimatter rockets to have a far higher energy density and specific impulse than any other proposed class of rocket. Matter/antimatter reactions produce 10 million times the energy produced by conventional chemical reactions such as the hydrogen and oxygen combustion used to fuel the conventional space

shuttle. With reactions that are 1,000 times more powerful than the nuclear fission produced at a nuclear power plant, or by the atomic bombs dropped on Hiroshima and Nagasaki, it is believed antimatter is an ideal rocket fuel for cosmic distances. It is believed that approximately 10 grams of antiprotons would be enough fuel to send a manned spacecraft to Mars in one month. Today, with conventional fuel, it takes nearly a year for an unmanned spacecraft to reach Mars. In 1996, the Mars Global Surveyor took 11 months to arrive at Mars. Scientists believe that the speed of a matter-antimatter powered spacecraft would allow man to go where no man has gone before in space.

Now it needs to be addressed that why haven't we built a matter-antimatter reaction engine yet? The answer is that the chief problem with developing antimatter propulsion is that there is a lack of antimatter existing in the universe. Although there was one study that said that even though there may be absolutely no naturally-existing anti-particles in our universe today, however, possible deposits of antimatter near the center of the galaxy may exist according to a scientific experiment that took place in this regard in 1977. But the fact of the matter is had there been an equal amounts of matter and antimatter in the Universe, then there would have been these matter and antimatter reaction happening all around us. But that isn t the case. So since antimatter doesn t exist around us, naturally we do not see the light that would result from the aftermath of matter-antimatter collision. And this means that we will have to create our own antimatter. Luckily, there is technology available to create antimatter through the use of high-energy particle colliders, and it is called atom smashers . Atom smashers, like the one at CERN, are large tunnels lined with powerful super-magnets that circle around to propel atoms at near-light speeds. When an atom is sent through this accelerator, it slams into a target, creating particles. Some of these particles are antiparticles that are separated out by the magnetic field. These high-energy particle accelerators only produce one or two picograms of

antiprotons each year. A picogram is a trillionth of a gram. All of the antiprotons produced at CERN in one year would be enough to light a 100-watt electric light bulb for three seconds. And it will take tons of antiprotons to travel to interstellar destinations. So there is a long way to go. NASA is believed to be possibly only a few decades away from developing an antimatter spacecraft. About a decade ago, in October 2000, NASA scientists announced early designs for an antimatter engine that could generate enormous thrust with only small amounts of antimatter fueling it. The amount of antimatter needed to supply the engine for a one-year trip to Mars could be as little as a millionth of a gram, according to a report in that month's issue of Journal of Propulsion and Power.

But there is a catch though. With such tremendous speed, how the astronauts are to endure such lightning speed journey? This remains a great challenge; in fact one of many of many challenges of manned interstellar space travels fueled by antimatter rocketry. But one interesting thing that an astronaut would experience with such high velocity journey is the time dilation, which is a slowing of time in accordance with the theory of relativity that occurs in a system in motion relative to an outside observer and that becomes apparent especially as the speed of the system approaches that of light. This time dilatation, the relativistic effect of the slowing of a clock with respect to an observer, can be further understood, first, in Special Relativity, where a clock moving with respect to an observer appears to run more slowly than to an observer moving with the clock. And secondly, in General Relativity, time dilation is also caused by gravity; clocks on the earth's surface, for example, run more slowly than clocks at high altitudes, where gravitational forces are weaker.

All in all, it can be safely stated that maybe we re not entirely ready for antimatter powered spaceships just yet. Even though it is highly mentioned and talked about in the science fiction books and movies of all kinds but maybe one day a future generation of astronauts will

gallantly make their way into an historic cosmic voyage on behalf of mankind.

Interstellar Space Travel: Imaginations, Wondrous & Magical Voyages

One way or another, Interstellar Space Travel (IST) has captivated mankind s imagination since the time we learned to look at the stars, galaxies and other magical components of the sky. IST has generated a great deal of enthusiasm, most of which can be seen in the popular science fiction books and films. Although the distances that are to be covered are vast and likely to take from years to millennia and a spectacular speed that are almost as the speed of light itself, far beyond the capabilities of the existing methods of our present spacecraft propulsion. But IST is indeed one of great interests amongst scientist and there are indeed quite a few ideas on how this miraculous task can be achieved.

The basic challenge to IST lies in not in the engineering capabilities but the immense distance between the stars. Say for example, the distance from Earth to the Moon is 1.3 light-seconds. And with current spacecraft propulsion technologies, a craft can cover the distance from the Earth to the Moon in around eight hours. That means light travels approximately thirty thousand times faster than current spacecraft propulsion technologies. The distance from Earth to other planets in the Solar System ranges from three light-minutes to about four light-hours. Depending on the planet and its alignment to Earth, for a typical unmanned spacecraft these trips will take from a few months to a little over a decade. As it is understood that light in a vacuum travels approximately 300,000 kilometers per second or 186,000 miles per second, the nearest known star to the Sun is Proxima Centauri, which is 4.23 light-years away. And the fastest outward-bound spacecraft yet sent, Voyager 1, has covered 1/600th of a light-year in 30 years and is currently moving at 1/18,000th the speed of light and at this rate, for Voyager 1, a journey to Proxima Centauri would take 80,000 years. This simply means some combination of great speed and long travel

times are required and if a speed like that of the travel of light itself can be achieved then the crucial aspect of the IST period can be curbed down considerably.

The physical and psychological challenges that astronauts have to endure are also one crucial aspect that requires a great deal of attention. The cosmic travelers of space and time will have to spend their entire journey floating about in the weightlessness of space which is likely to have an adverse physical and psychological impact on the people on board the ship. Effective ways must be considered to tackle that crucial situation so that the astronauts remain healthy both in mind and body and able to carry out mission objectives for all the years to come.

Interstellar space travel, as exciting as it sounds, has several other technical challenges. Like, a major issue with traveling at extremely high speeds is that interstellar dust and gas may cause considerable damage to the craft, due to the high relative speeds and large kinetic energies involved. Virtually all the material that would pose a problem is in our solar system, like the planets, asteroid belt, Oort cloud (a region of the solar system far beyond the orbit of the dwarf planet Pluto in which billions of comets move in nearly circular orbits unless one is pulled into a highly eccentric elliptical orbit by a passing star), comets, asteroids, macro and micro-meteoroids, etc. The larger the object humans send for IST, the greater the chances of it hitting something. One option is to send spacecraft, comparatively very small in size where the chance of it striking something is virtually non-existent in the vacuum of interplanetary and interstellar space. Various shielding methods to mitigate this problem have also been proposed. Some other challenges that scientists think that an interstellar ship would face in its cosmic journey includes vacuum, radiation, weightlessness, and micrometeoroids. Interstellar communication is also another concern, even if a probe reaches the nearest star, its ability to communicate back to Earth would be difficult given the extreme distance. But the time factor remains the biggest challenge. Assuming

one can not travel faster than light; one might conclude that a human can never make a round-trip further from the Earth than 40 light years if the traveler is active between the ages of 20 and 60. So a traveler would never be able to reach more than the very few star systems which exist within the limit of 10 20 light years from the Earth.

Einstein s Special theory of relativity offers the possibility of shortening the travel time: if a starship with sufficiently advanced engines could reach velocities approaching the speed of light, relativistic time dilation would make the voyage much shorter for the traveler. In this time dilation, casually explained, clocks aboard ship will run slower than Earth clocks, so if the ship engines are powerful enough the ship can reach mostly anywhere in the galaxy and go back to Earth within 40 years ship-time. The problem is that there is a difference between the time elapsed in the astronaut's ship and the time elapsed on Earth. This means, in the mind of the astronaut only 40 years have passed whereas on Earth, thousands of years have passed on and the world the astronaut left exists no more, for better or worse. Einstein s General theory of relativity also coins this grand idea that faster-than-light travel may be possible without violating fundamental laws of physics, for example, through wormholes, although it is still debated whether this is possible, in part, because of causality concerns and proposed mechanisms for faster-than-light travel within the theory of general relativity require the existence of exotic matter.

Now, what are some of the most preferable cosmic locales where such IST is somewhat a possibility? Scientists have identified some extra-solar systems which are good candidates for any IST. Firstly, we have Alpha Centauri, the closest star system to ours where the journey by light years standard is about 4.3 years. Next we have, Barnard's Star, with 6 Light Years Away (LYA), it is the second closest star system to that of ours. And this is followed by Sirius, 8.7 LYA and Epsilon Eridani, 10.8 LYA, with a single star slightly smaller and colder than our Sun and likely to host a Solar-System-type planetary system. 11.8 LYA, Tau Ceti is another candidate, with a single star similar to the

Sun and high probability of possessing a Solar-System-type planetary system, current evidence shows 5 planets with potentially two in the habitable zone! Also of course the Gliese 581 star system located 20.3 LYA, with Gliese 581 g and the confirmed exo-planet Gliese 581 d are in the star s habitable zone. Gliese 667C is another ideal solar system candidate for IST, placed 22 LYA, it is a solar system with at least six planets and record-breaking three of these planets are super-Earths, lying in the zone around the star where liquid water could exist, making them possible candidates for the presence of life. And of course the Vega star system, famous for it s citing in Carl Sagan s epic novel Contact , situation 25 LYA and believed to house at least one planet which is of a suitable age to have evolved to host a primitive life!

One highly interesting aspect of traveling to light year s distance is the process of life extension of astronauts, i.e. the human occupants in the spaceship. We have seen ideas concerning this very subject matter coming into life in various Hollywood movies like Aliens or Prometheus and so on. Human hibernation, cryonic preservation, sleeper ships are some scientific concepts that are thought to be possibly effective in cases where the astronauts are to lie/rest motionless for a very long time to remain physically fit, remain young and beat the perils of old age for the future purpose of their cosmic mission. But what if artificially generated extended human lifespan method is not effective? As for alternative, some say robotic space mission carrying some number of frozen early stage human embryos is another theoretical possibility where the presence of human life-forms can always be ensured in the cosmic voyage of the spacecraft. This method of space colonization requires, among other things, the development of a method to replicate conditions in a uterus with the prior detection of a habitable terrestrial planet by fully autonomous mobile robots and educational robots which would replace human parents and guide the future astronauts to their youth when they are

able to take full control of their lives and carry out the mission objectives.

Not all of us are rocket scientists and propulsion engineers, so let us simply be aware of some modern rocketry concepts that are on the idea table of scientists concerning interstellar travel. We have already learned in brief about the antimatter rocketry concept in this regard, other similar futuristic concepts include, nuclear fission powered engines like nuclear-electric or plasma engines rockets, nuclear fission-fragment rockets, nuclear pulse propulsion rocket engines and as for nuclear fusion rockets like, nuclear fusion rocket starships, powered by nuclear fusion reactions are some futuristic rocketry ideas that should conceivably be able to reach 10% speed of that of light. If a spaceship could average 10% of light speed (and decelerate at the destination, for manned missions), this would be enough to reach Proxima Centauri in forty years.

What about some non-rocketry concepts? A problem with all traditional rocket propulsion methods is that the spacecraft would need to carry its fuel with it, thus making it very massive, in accordance with the rocket equation. And not to mention the massive payload the rocket itself has to endure. For instance, the first space probe, Sputnik 1, had a payload of 83.6 kg, while Sputnik spacecraft that carried a living passenger (Laika, the dog) had a payload six times that at 508.3 kg. Given the vastly greater travel times involved and the resulting necessity of a closed-cycle life support system, a manned craft will require much, much more heavier payload and not to mention a considerable time-frame to reach its top speed as humans have limited tolerance to acceleration. A light sail or magnetic sail powered by a massive laser or particle accelerator in the home star system could potentially reach even greater speeds than rocket propulsion methods; because it would not need to carry its own reaction mass and therefore would only need to accelerate the craft's payload. Beamed propulsion seems to be the best interstellar travel technique presently available, since it uses known and established

concepts of physics and known technology that is being developed for other purposes and likely to be considerably cheaper than nuclear pulse rocket propulsion.

Let s get a little more dangerous. Is faster than light travel possible? According to scientific minds, there are a number of ways by which it might be possible to surpass the speed of light but all of these are speculative. General relativity may permit the travel of an object faster than light in curved space-time. One could imagine exploiting the space-time curvature to take a shortcut from one point to another, much like the wormhole, but this particular idea is one form of the warp drive concept. Continuing to this faster that light travel subject-matter, in physics, the Alcubierre drive is based on an argument that the curvature could take the form of a wave in which a spaceship might be carried in a bubble . The motion of the wave would carry a spaceship from one space point to another in less time than light would take through unwrapped space. Nevertheless, the spaceship would not be moving faster than light itself within the bubble and this spectacular concept would require the spaceship to incorporate a region of exotic matter or negative mass . And as for what is exotic matter, to be simple it is a kind of matter that is non-baryonic, i.e., not made of baryons (the subatomic particles, such as protons and neutrons, of which ordinary matter is composed of). Exotic matter is a hypothetical kind of matter that has both a negative energy density and a negative pressure or tension that exceeds the energy density. All known forms of matter have positive energy density and pressures or tensions that are always less than the energy density in magnitude. In a stretched rubber band, for example, the energy density is 100 trillion times greater than the tension. A possible source of exotic matter lies in the behavior of certain vacuum states in quantum field theory. And with exotic matter, faster-than-light travel might become a possibility!

The Truth is, Surely, Out There

The belief in the existence of extra-terrestrial life should come naturally and as an aspect of human intellect that must be inspired by,

above all, common sense. It is somewhat egoistic to think that life does exist solely on planet Earth and no where else in the Universe. Earth does not have any copyright on life just as life does not have any legal hold on Earth itself. Earth is a planet where life happens to have evolved, simply because all the conditions were right. Earth and the evolution of life on Earth is a part of natural cosmic process. And since this miraculous event has taken place on an ordinary planet like Earth that is located on an ordinary locale in an ordinary galaxy that resides in an ordinary setting of the magnificent cosmos, chances are same has taken place elsewhere in the Universe. As we understand that life itself is a force that evolved for its own sake, it is likely that the same force or energy, which evolved, here on Earth, into groups of species that can be characterized based on their physiological structures, is also at work on a different planet/s, progressing itself or already has evolved into beings that can think for themselves. We have seen that scientific calculations suggest that such planet exist in thousands even though we haven t so far encountered any being from any other planets, at least officially. But the effort is there and science, so devotedly and patiently, is steering mankind s quest for life beyond Earth. We have managed to point out some planets that we think may have the potential to host life-forms and some even have the capabilities to house intelligent ones at it as well. The search is on. Radios and satellites are on the way and more revolutionary methods of communication are in progress keeping the future in mind. And once in a while we see a little glimpse of hope, see the great possibilities for the answer to our quest for life beyond Earth. Hopefully we are not that far from the truth. We have gladly commenced our journey into the deeper space, we are out there, and surely one of these days we will have our day with the truth, once and for all.

But then again some say, the answer was always there, the truth concerning the existence of extra-terrestrial life-forms, some say it was there but definitely not out. At least to the extent that would officially reach us. And this speculation led to many theories, ideas

that further paved the way to the conspiracy theories regarding the existence of alien life-forms and the famed UFO phenomenon. There are many, many conspiracy theories out there concerning this topic and one is more spectacular than the other. Now whether they are true or false that s a very different argument but some stories are indeed interesting while some are bizarre and some are downright frightening and mysterious.

It is agreed that everybody likes a little mystery. Things are some what appealing when they are interesting. For decades there has been this obscurity regarding the extra-terrestrial affairs that have been often mystified by the UFO phenomena and more. And not only that numerous other conspiracy theories that involve governments and secret societies, alien abduction theories, secret alien bases on Earth, cattle mutilation by visiting aliens, crop circles created by alien ships and numerous other strange ideas, accounts, speculations and assumptions have only added a great enigmatic inexplicability concerning the possible far away beings from different far away planets. Some say they are true as Earth itself while some say these stories are just works of idle minds that have induced by boredom and even psychedelic intoxicants.

But indeed there are more things out there than what meet the eyes.

And it is our duty to look for them, to search for truth beyond all the scrutiny and challenges; and to learn them for better and to better ourselves through the learning.

Because that s what being human being is all about.

Epilogues

Of Humans & Extra-Terrestrials

After all that have been said and done, it should be evident that life does exist elsewhere in the Universe, beyond our own planet Earth. Some day in the future we will come across them, one way or another, or they will find us and it s all just a matter of time, for better or worse. While the search for life is ongoing, what exactly are we to do once we find one? Many have asked this question and undoubtedly this being a vital issue, which direction we are to precede once we have made our contact with an extra-terrestrial life-form, intelligent or otherwise? Given the sayings that all relationships are power struggles at the core, how the link between human-beings and other celestial community/s would form and shape, will it usher goodness that will be shared by all or it will simply pave the way to some sort of conflict that will jeopardize the very future of existence itself? Will the future extra-terrestrial and Earthling relationship be a friendly one or a warring one, like so many Hollywood movies have flamboyantly portrayed?

Even if we discover the microbial existence of some alien life-form, how the decision makers of the world would manage it and what will be the implications of such crucial discovery? Would the certain groups of the World leaders use the knowledge learned from the study of such alien life-forms to build deadly biological weapons or cunningly device just another mean to impose self-interested control over the well-being of the people on Earth? Would the same powerful groups of people choose to keep the contact between Earthlings and extra-terrestrial beings (especially the intelligent ones, far from the microbial kinds) from different planet/s a matter of secret just to fulfill their vindictive and narcissistic-fiscal agendas? There are many conspiracy theories in this regard, most of which are shrouded in great mystery. But those conspiracy theory laden topics will perhaps be discussed in another book.

Indeed there are risks, and they are surely far too many.

But for now, the fact remains that if we make contact with beings from another planet we are to be extremely careful, for our sake as well as for their sake. Before we devout ourselves to the knowledge concerning all that is to know about alien life-forms, we need to learn a lot more about ours. And that is because, with better understanding of ourselves, perhaps we will be able to exercise wisdom, intellect, astuteness and maturity accurately when it comes to dealing with extra-terrestrial life-forms who might as well turn out to be much smarter than us or the opposite compare to us.

We have tried to understand the aspects of extra-terrestrials a lot, but for now let s try to understand the Humans for a while.

The human beings today have sincerely outdone themselves with the extent of knowledge mastered and all the triumphs that have been realized. Nothing can deny the fact that what a remarkable species human beings are but if simple biology is considered then at the end of the day human beings are in-fact just another species like the rest of the ones sprawling around at different corners of the world. Every single one of us is born as one of the homo-sapiens but perhaps being human is one astounding process that everyone has to go through and evidently earn themselves the good name. And the graduation of such process could certainly be referred as Humanity.

Frustratingly not all of us get to graduate.

Mankind has indeed come a long way through the path of time that is composed of years in millions. With remarkable achievements, our superiority has reached splendor and undoubtedly the past, present and the future belong to us and us only, should we play our cards right that is. And throughout all these time, mankind has endured numerous challenges and in the end, powered their excellence by conquering over all the impediments and enmity that had, at the beginning, the potentiality to defy their dominance. But sadly mankind is yet to master his archenemy.

Mankind himself!

Given the nature of responsibilities and success of evolution, mankind turned out to be the ultimate guardians of this planet but ironic as it is the world has been subjected to constant brutalization from none other than her very own guardians themselves. But nothing compares to the extent of damage mankind did to themselves. In the days of our innocence we would read one third of the world is covered with land and the rest is with water. And since the dawn of time man has been fighting with each other to establish the idiosyncratic authorities over that one third of this dear planet. It seemed as there is nothing else left for mankind to hound on, and so they have, out of their sheer wisdom , selected themselves as targets of this silly game of ascendancy. And to this very day man have been battling each other and no matter how fancy the words are chosen as for the cause, the primal reason for such mayhem remains to institute supremacy over the counterparts. It s quite a shame that these primitive instincts of territoriality still gets the best, rather worst, of us overwhelming all the steep glory of arts and sciences.

The constant efforts towards the betterment certainly reflect our preference towards tranquility. And these labors towards betterments are instigated by our ability to choose. This aptitude is truly a gift that the majority of our kind is born with. And when this ability to choose and the power of intelligence merge together, the excellence of ours is established. The dilemma is that the product of these excellences is being systematically manipulated and the mass imprison themselves with the shallow notion of materialistic utopia. And over time all this has lead to the creations of divisions and groups and eventually the factors of colors, races and religions have become issues and all these have lead to nothing but fierce confrontations between mankind themselves.

Amongst all, mankind is probably the most apprehensive species and this insecurity has probably instigated the vigor of greed in all of us which is responsible for the idea that material possessions will usher

sanctuary in every extent of our lives. Wretchedly mankind also happens to be a displeased one as the motivation towards betterment is often influenced of having more by any means and ways what so ever. Overtime the submission towards greed has engineered this illusion of certainty amongst us which in effect has exposed the world to a great uncertainty. It seems mankind will extort everything from this dear earth until the day Earth says I have nothing else to give. It seems with the pass of days, sadly, the World is not enough for mankind, it never was nor will it ever.

The blessings of civilizations mesmerize us with wonders but despite all these achievements and changes in the ways of progress, mankind is yet to come out of their primordial nature. Yes and yes indeed mankind is clothed, nurtured but still a species. The old saying of survival of the fittest and the natural selection theories still applies today in these days of Face book, Twitter and much more. Mankind is certainly the superior species and arguably both the best and worst species altogether. The extent of cruelty and compassion practiced by our kind is truly spectacular. Perhaps, everything comes down to the power of choice and that s what clearly graduates mankind to Human beings.

And with that power of choice comes down the calling of responsibility.

We need to be responsible towards ourselves and our own planet in order to understand properly and respect without any prejudice, the life-forms and possible civilizations from other planets. Understanding the extra-terrestrial life-forms and their norms, values and unique ways of life will require a certain level of wisdom and maturity from our end just as it our requirement from theirs. What has been applied to human beings, both good and bad elements, perhaps might as well be applied to species from some distant planets as well. May be they are, as we speak, equally violent and compassionate at times, much like us, because at the end of the day, we all are life forms with certain common characteristics that should exist in all living beings.

Along side this mutual respect for all life-forms, both terrestrial and extra-terrestrials, a great deal of caution must be exercised as well so that there is no room for any accidents or worse, an alien invasion of any kind. We need to show both courage and insight to look out for extra-terrestrial life-forms as well as to restrain from any potential hostile ones, should we find any, whether it s microbial or even otherwise. There are many things that take place on Earth which we do not understand, despite years of study. It won t be surprising if we fail to understand a great deal about extra-terrestrial life-forms. After all they are likely to be quite different from us, both in mind and body. So vigilant approach is a must when to look out for alien life-forms, at all times.

It is understandable that human beings have always been fascinated by the thought of extra-terrestrial life-forms since the beginning of civilization. And the cave paintings of such celestial beings as ancient as 10,000 BC in the cavern of Val Camonica, Italy to the Hollywood blockbusters like Avatar only signify man's fascination with things extra-terrestrial in origin. Even though the media have projected aliens both, as good guys (Spielberg's E.T) and bad guys (Ridley Scott's Aliens), the global scientific communities have been relentless in their search for such beings within and beyond the solar system. Numerous satellites and radio-telescopes are scanning the skies as well as radio waves are being sent with the hope that someday our lonely Earth will find a friendly neighbor somewhere in this cosmos.

As we were saying, what if it may turn out that the extra-terrestrial is not so friendly towards us after all! Briefly discussed much earlier, according to the eminent astrophysicist, Stephen Hawking, the chances are aliens are out there, but any interactions with their kind with humans might bring disastrous consequences for this planet and its inhabitants! In a T.V documentary series titled Into the Universe with Stephen Hawking , the former Lucasian Professor of Mathematics, back in 2010, gently warned us with these words: If aliens visit us, the

outcome would be much as when Columbus landed in America, which didn't turn out well for the Native Americans .

In the documentary program for the Discovery channel, Dr. Hawking expressed his firm belief in the existence of intelligent alien life-forms on other planets. He pointed out that, there are more than 100 billion galaxies out there each containing hundreds of millions of stars. So the thought that the systematic evolution of life only took place here on Earth is somewhat impractical. Besides, according to Hubble Telescope's own observations, there are at least 6.25 billion life-supporting solar systems out there! In the words of the legendary theoretical physicist, To my mathematical brain, the numbers alone make thinking about aliens perfectly rational. The real challenge is to work out what aliens might actually be like . He speculated that most extra-terrestrial life would be similar to microbes or small animals that could exist beneath Martian surface, where liquid water is thought trickle through the rock. And massive marine creatures could also conceivably exist as well in the oceans underneath the mile-thick icy layer of Europa, one of Jupiter's 4 moons. But what lies beyond our solar-system that is a whole different story. According to Hawking, if there is a scientific census of the rest of the Milky Way and beyond, the odds in favor of life's existence would rise dramatically. And Prof. Hawking thinks that's exactly where the true risk lies.

The famed astrophysicist further stated that, I imagine they might exist in massive ships having used up all the resources from their home planet. Such advanced aliens would perhaps become nomads, looking to conquer and colonize whatever planets they can reach . Expeditions into the heavens is indeed a risky business and the scientist believes that instead of seeking them out, humanity should do all that it can to avoid any such contact. Despite being a prominent advocate of space travel, Hawking remains skeptical of man's search for extra-terrestrial civilizations. We only have to look at ourselves to see how intelligent life might develop into something we wouldn't

want to meet , said Dr. Hawking. True, human beings haven't still learnt to coexist peacefully.

But does this mean that we should absolutely stop looking for the answer to the greatest question that there ever was? Probably not. We will keep searching the skies for answers, treasure our quest for life beyond Earth and seek out and share knowledge and understandings from life-forms from different planets. We ought to. We have evolved in to fine living species and the next frontier is space and beyond. We owe it to our self the truth about the uniqueness of life on Earth. We understand the logic and the possibility of life elsewhere in the Universe. We have seen how the Universe came into being and the stories of stars, planets, galaxies, nebulae and all those magnificent wonders of this grand cosmos. We learned about the evolution of life on Earth hoping that it would shed some light on how life might develop, grow and mature in some distant alien planet. We also learned on how alien life might exist within our own solar system and how the thoughts and the study on the possibilities of life on distant planets have fascinated mankind, since always. And as time progressed and our technological know-how matured, we discovered planets in far distance of the cosmos and how they might actually host extra-terrestrial life-forms.

We have come a long way, so has the Earth and the Universe. But our travel doesn t end here nor does our process of evolution. We are in the midst of something great, spectacular. Our future is great and this greatness will be enhanced further with our increase of knowledge. The search for extra-terrestrial life-forms is as important as any matter that inspires human growth and the betterment of mankind. The grand colossal nature of the Universe inspires us to reach out for more and along with it grow a little more as well. The subject matter of extra-terrestrials and alien civilizations is not so alien or distant as many would like to think. Just as we ponder over such possibility, chances are some beings out there are doing the same, in their own unique way. Even though, so far, we have not found any specific proof on the

existence of alien life but that certainly does not mean that there isn t any, as we have seen, chances are there are many planets out there hosting alien life-forms as we speak.

Now we continue to evolve and witness with wonder the progress of science and technology, eventually we are likely to discover extra-terrestrial life some time in the near future. We should be ready to accept by then what is now seems inevitable, that life exist elsewhere in the Universe. And when we discover other planetary beings, be it microbial or otherwise, we must be smart in dealing with that matter so that the contact does not compromise the well-being of each other. We should strengthen our focus on knowing each other with proper insight and understanding.

Once we ve found what we are looking for, we must focus on developing a rapport that is balanced and complimentary, one that enhances a union of goodwill between all kinds of life-forms from such different planets settled in their respective corners of the Universe.

Like establishing a cosmic brotherhood.

Just like God intended.

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